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**FIRM-LEVEL UPGRADING
IN LOW- AND MEDIUM-TECHNOLOGY INDUSTRIES
IN EMERGING MARKETS:
THE ROLE OF LEARNING IN NETWORKS**

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Thesis submitted in partial fulfilment of the requirements for the degree of
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**Science and Technology Policy Research (SPRU)
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I hereby declare that this has not been and will not be, submitted in whole or in part to another university for the award of any other degree.

Signature:

**For my mother, Sevim
and my father, Yasar**

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UNIVERSITY OF SUSSEX

Deniz Eylem Yoruk

Doctor of Philosophy

Firm-level Upgrading in Low- and Medium-Technology Industries in Emerging Markets: The Role of Learning in Networks**ABSTRACT**

This thesis investigates how involvement in networks contributes to firm-level upgrading in emerging markets. In the 1990s, the international de-localisation of production and global integration has brought about a process of upgrading for firms in the transition and latecomer industrialising countries that allowed them to approach the technological frontier and enhance their competitive position. Hence, the firm-level upgrading became a process of improving technological and organisational deficiencies in the firms' knowledge base, particularly through knowledge transfer and learning in networks they have involved in, enabling them to adjust to the new environment by doing things differently and/or better as well as doing different things.

The literature on upgrading stresses the effects of value chains and production networks on industrial upgrading, while the role of various learning mechanisms is largely unexplored. Employing an evolutionary perspective, this thesis contributes to existing analyses by considering the role of knowledge networks and by using 'learning in networks' as a bridging concept, by which the interaction between inter- and intra-organisational knowledge transfer is demonstrated to have significant bearing on hastening the process of catching-up in emerging markets. Specifically, this thesis examines what characteristics of the networks of Polish food-processing and clothing firms affect learning mechanisms in an inter-organisational context and how these mechanisms combined with internal factors supporting internalisation of externally acquired knowledge (including firm strategy orientation) contribute to various types of firm-level upgrading during the period 1989-2001.

Methodologically, this thesis proposes a dynamic model of firm-level upgrading with a novel unit of analysis: the relationships of the firm. So, rather than using firm case studies, it provides statistical evidence typically lacking in the upgrading research, while not sacrificing the in-depth nature of case studies, as each relationship of the firms studied has been investigated through face-to-face interviews that are translated into a dataset of relationships analysed using multinomial logistic regressions.

First, the network-related characteristics of external learning mechanisms were identified and then used as a reference point in the upgrading analysis. The results for product upgrading largely confirm the previous findings in the literature. However, the upgrading of production processes is a function of learning from advances in science and technology through knowledge networks. Strikingly, learning-by-interacting in production networks actually appears to impede managerial (rather than functional) upgrading, a previously unexplored upgrading type, which is also shown to be a pre-requisite for functional upgrading. While learning-by-training and research within the firm is a potent condition for external learning mechanisms to contribute to all of the upgrading types, for successful functional upgrading, it is a must. These findings show the importance of the use of an integrative approach to learning in research on upgrading.

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LIST OF ABBREVIATIONS

AL	Arm's length
BERD	Business enterprise expenditure of R&D
CAD	Computer-aided design
CEE	Central and East Europe
CEECs	Central and East European Countries
CIM	Computer integrated manufacturing
CIS	Community innovation survey
CM	Contract manufacturing
CMEA	Council of Mutual Economic Assistance
CSO	Central Statistics Office of Poland

DPNs	Domestic production networks
EBRD	European Bank for Reconstruction and Development
EDI	Electronic data interchange
EU	European Union
FDI	Foreign direct investment
FTOs	Foreign Trade Organisations
GCC	Global commodity chain
GDP	Gross Domestic Product
GERD	Gross Expenditures in R&D
GPNs	Global production networks
GUS	Central Statistical Office of Poland
GVCs	Global value chains
HACCP	Hazard Analysis and Critical Control Point
ICTs	Information and communication technologies
I/LM	Interaction model of learning
IMF	International Monetary Fund
ISO	International Standards Organisation
IU	Industrial upgrading
I/UM	Interaction model of upgrading
JVs	Joint ventures
KBN	Committee for Scientific Research
LM	Learning Model
LMT	Low- and Medium-Technology
M&As	Mergers and acquisitions
MCA	Multiple correspondence analysis
MLR	Multinomial logistic regression
MNCs	Multinational Companies
MRP	Materials requirement planning
MRPII	Manufacturing resource planning
NIS	National innovation systems
OBM	Own-brand manufacturing / manufacturer
ODM	Own design manufacturing / manufacturer
OECD	Organisation for Economic Cooperation and Development
OEM	Original equipment manufacturing / manufacturer
OPT	Outward processing traffic
PAIZ	Polish State Foreign Investment Agency
R&D	Research and development
SMEs	Small and medium-sized enterprises
SOEs	State-owned enterprises
S&T	Science and technology
TQM	Total quality management
UM	Upgrading Model
UNECE	United Nations Economic Commission for Europe
VC	Value chain
WTO/ATC	World Trade Organization / the Agreement on Textiles and Clothing

Chapter 1 INTRODUCTION

1.1 THE RESEARCH QUESTIONS

International competition and economic integration between countries have reached a level that forces firms to cope with new challenges rapidly (Dicken 1992). Since 1990, many of the countries once labelled as ‘socialist’ and ‘developing’ have been re-labelled ‘emerging markets’ as global economic integration has allowed them to grow much faster than the developed countries, making catch-up for many of them possible. But this catching-up process has been challenging.

In one group of emerging markets, the Central and Eastern European countries (CEECs), firms have undergone almost all the basic problems of the post-socialist transition at differing levels. Studies of the patterns and determinants of transition reforms have agreed that micro-level progress is largely dependent on how macro-level progress is shaped and governed (e.g. Sachs *et al.*, 2000). This has been the main factor used to explain the differences among CEECs (e.g., Poland’s advancement vis-à-vis Romania). While accepting that healthy macroeconomic fundamentals, the timely generation of the institutions and relevant policies necessary for a free market economy play a significant role in the upgrading of transition countries’ economies, this thesis aims to show that there are other underlying issues, such as changes in global industrial organisation and development of national innovation systems (NIS), that have a crucial effect on micro-level upgrading and development. Moreover, in addition to distinctive histories, strategies and cultures that underpin upgrading efforts within firms, there are also micro-level external factors that shape the way emerging market firms face the upgrading challenge, one very important such factor being networks. However, there is very limited research on networks in transition countries that provides information about what is really going on in these networks, especially to what extent they transfer effective knowledge and technology that favours the firms’ upgrading (Dyker 2004d).

These firms can handle some problems on their own, but for others they need to join forces with partners, i.e. through networking. Today they have to find market niches quicker than they used to and develop an innovation culture. Engaging in networks is an important element of a sustained strategy of continuous learning and keeping up with new technologies. The evidence (particularly from Latin America and East Asia) also

indicates that emerging market firms need external knowledge to upgrade and can best access it through networks (i.e. not through market or hierarchic relations exclusively) which include, for example, relationships with research institutes, knowledge transfer from technology suppliers, relationships with foreign strategic investors and global buyers, etc. (Hobday 1995, Borrus 1997, Zysman *et al.* 1997, Ernst 1997, 2000b, 2001, Ernst *et al.* 1998, Linden 1998, Henriot and Inotai 1998, Graziani 1998, Comisso 1998, Borrus *et al.* 2000, Dyker *et al.* 2003, Schmitz 2004, 2006). But the processes or mechanisms by which networks acquire such strategic importance, especially for emerging market firms, are not detailed in the upgrading literature. Therefore, this research examines the role of networks in firm-level upgrading in the context of emerging markets. The main research question it tries to answer is:

- *How does involvement in networks bring about firm-level upgrading?*

The boundaries of this research question constitute one of the novel approaches to the study of upgrading in emerging markets. It does not focus only on the most-researched, dominant type of networks (i.e. global value chains – GVCs / global production networks - GPNs), but focuses more broadly on various types of networks. In this way, it aims to answer what characteristics of different network types lead to learning and therefore contribute to firm-level upgrading. By answering this research question, most importantly, this research aims to contribute to the upgrading literature by unpacking the ‘assumed’ spillover and learning effects on upgrading within the firm, which are largely mentioned but not examined in detail in existing work. Using networks and learning as tools of analysis, a two-level research is designed to achieve the main objectives of this study, exploring first inter-organisational level before turning to the intra-organisational level. In accordance with this research design, the main research question is broken down into the following sub-questions:

- *How does learning take place externally through networks?*
- *How does learning in networks contribute to different types of firm-level upgrading?*

To empirically examine how networking activities of the firm affect its upgrading, this thesis makes use of learning mechanisms as a bridging concept between networks and firm-level upgrading. These three concepts are linked to each other within a conceptual framework built on three underlying literatures of the investigated research questions. This thesis seeks to integrate a new perspective into the upgrading literature with the insight gained from the literatures on networks and learning. The overarching aim of

this thesis is to advance our understanding of firm-level upgrading through the process of ‘learning in networks’ (Håkansson *et al.* 1999). Thus, this thesis focuses, first, on the relationship between networks and learning in order to examine the effects of various characteristics of networks on ‘learning mechanisms external to the firm’ (Malerba 1992), and second, on the contribution of these learning mechanisms in networks to upgrading at the firm level. Learning mechanisms in networks cover not only external learning mechanisms but also internal factors that are needed for internalisation of externally acquired knowledge. Therefore, intra-organisational learning in this thesis is confined to issues directly related to the assimilation of information and knowledge from inter-organisational networks.

Complementary to the analysis of learning in networks as source of firm-level upgrading, this research also looks at the influence of the firm strategies that are developed within a specific orientation as a result of the relationships of the firm and tries to answer a further sub-question:

- *How does the firm’s strategic orientation affect firm-level upgrading?*

As a result, this research will construct an analytical framework for exploring a variety of learning mechanisms in networks, originating from both production and knowledge systems (Bell and Albu 1999), allowing us to extend the analysis of firm-level upgrading beyond value chains. Such employment of the upgrading concept at the network level is seldom found in the literature. This research situates these questions within the context of large firms in low- and medium-technology industries (LMT) during the transition period (1989-2001).

1.2 THE EMPIRICAL CONTEXT

The abovementioned research questions are going to be examined in the context of the Polish food-processing and clothing industries. This section presents the empirical context of this research. It aims to introduce the country chosen among CEECs and the industries chosen from low- and medium-technology sectors for studying the above research questions. It also discusses why they are relevant for this research.

1.2.1 A Central European Country: Poland

This research is conducted in a Central European country, namely Poland. Poland is one of the Big Ten emerging markets identified by Garten (1996), hence I will refer to it as an ‘emerging market’ hereinafter. At the end of the first ten years of transition, Poland appeared to have achieved one of the most successful reform among the CEECs with regard to its high economic growth rates and general consistency of economic policy (Gomulka, 2000; Belka 2001).

Despite the historic political changes in the region, the change from centrally-planned to market economy did not happen as easily and smoothly as expected, particularly due to the inherited economic problems. With the fall of communism, the Polish economy, like other transition countries, found itself in macroeconomic imbalances and therefore initially suffered from falling output, rising unemployment, high inflation, collapsing foreign trade relations due to disintegration of Council of Mutual Economic Assistance (CMEA) and switch to western markets, whose demand required advanced industrial input and product structures, and increased current account deficits resulting from the inherited external debts of the late 1980s (UNECE 1992a). Moreover, its industries were not internationally competitive, with the production of goods and services in many sectors dominated by monopolies and a lack of mobility of capital and labour in the economy (World Bank, 1990).

In addition, experiences from the times of central planning have created barriers to firms in their gradual integration into the functioning of a market economy. Because under socialism firms were only production units with no other capabilities inherited in the value chains, they had no relationships with the suppliers and did not know their customers but only produced the amounts they were ordered with the raw materials supplied. With the transition, there was much for firms to learn.

The early 1990s also represented a geographic reorientation of Polish trade relations from CMEA countries towards the OECD and EU countries (UNECE 1992b).¹ Poland had the smallest concentration of trade to the CMEA at the end of the 1980s, accounting for about one third of its total trade in 1989. However, the demise of CMEA trade and

¹Poland's trade relations with OECD countries date back to 1980s, alongside the CMEA partners. CMEA system of trade and payments was dismantled in 1990 (Economic Bulletin for Europe 1991).

the similar reform efforts being undertaken simultaneously in other CMEA partners with similar product quality and compositions magnified the decline in Poland's trade with those countries, which fell to 7.8% of its total trade in 1993.

Compared to the rapid pace of the reforms in the first years of transition, in the mid-1990s, progress in tackling difficult challenges slowed down (EBRD 1999). Rapid output growth together with large productivity gains (as a result of new capital equipment) was accompanied by low employment growth, except in 1996 when it increased by 3.5%. There were substantial net increases in gross fixed capital formation until 1998 (e.g., a 22% increase in 1996-1997 that has not been repeated since; see Table 5.1). "In 1994-95, fixed capital formation increased in both groups [large enterprises and SMEs] but private sector investment continued to significantly outpace investment in the public sector (SOEs and administrations)" (OECD 1996-97: 21).

FDI inflows to Poland played a role in the continuing growth of the private sector during the transition years. Beginning from very modest levels of FDI in the early years of transition (401 million USD), in 1993-1998 Poland attracted 11,564 million USD worth of FDI.² However, while in 1998, Poland attracted 40% of all FDI flows to CEE and the Baltic States (EBRD 1998), in 2001, net FDI inflow in Poland represented only 3.2% of GDP, compared with 9.7% in Estonia, 8.7% in the Czech Republic, and 6.3% in Slovakia (Commission of the European Communities, 2003: 11). By 2003, the majority of FDI entered Polish markets through greenfield investments (51%), acquisitions (20%) and privatisation processes (22%), while joint ventures accounted for only 7% (PAIZ 2003). In 2003-2007, total FDI inflows increased to 51,710 million USD (see Table 5.4 in Chapter 5). In general, FDI inflows averaged 3.5% of GDP in Poland between 2000-2006, compared with 5% in Hungary and over 7% in the Czech and Slovak Republics (OECD 2008). Despite substantial levels of FDI inflows (totalling 111,526 million USD in 1989-2008), since 2000 they have been lower than in other transition countries. The ratio of FDI inflows to GDP fell from 5.6% in 2000 to 0.7 % in 2012, albeit with the occasional recovery (e.g., to 5.8% and 5.5% in 2006 and 2007

² In the early transition years, the Polish economy was experiencing a capital account deficit and was not so attractive for foreign investment. During the early 1990s, Poland lagged behind the other central European countries in attracting FDI. Despite the liberalization of foreign trade, which created a more favorable environment for foreign investment, foreign investors, were not convinced about the certainty of implementation of regulations and not comfortable with the lack of practices of competition.

respectively) and a stable 3% on average during 2008-2011 (UNECE Statistical Division Database, 2013).³

Poland experienced very slow growth and rising unemployment during the 1998 -2001 period. Three underlying reasons for this slowdown are implementation of tight monetary policies in 1997 in the view of the emerging signs of overheating; the adverse effect of Russian financial crisis (in August 1998) on exports as well as business and consumer confidence, and the economic slowdown in the EU (mostly Germany) during the winter of 1998-99, which significantly reduced exports (OECD 2000). The Russian crisis did not hit Poland as badly as expected due to strong domestic demand which helped the Polish economy only slow down (rather than shrinking) and to rebound in mid-1999 (OECD 2000).

Inflation continued to decline considerably compared to previous periods, and even saw single digit level (7.3%) in 1999 for the first time (although in 2000 for the first time since the beginning of transition, inflation increased - to 10.1% - rather than falling). Low inflation levels together with a relatively loose fiscal policy and aggressive interest rates cuts by the National Bank of Poland boosted household disposable income and thereby domestic demand and led to a credit boom (OECD 2000). However, the domestic market was still growing slowly, which was not in favour of consumer industries, like food-processing and clothing.

A strong recovery started in 2002 and remained vigorous until the downturn linked to the global credit crunch in 2007-2008. Most of this recovery was export-led (i.e. through increase in activities of export-oriented industrial sectors) (OECD 2004). In addition, in May 2004, Poland entered the EU, and this gave an important boost to its economy. It has started to receive significant EU funds to improve public infrastructure, regional and small business development, etc. (OECD 2006).

The OECD (2004: 138) summarised this situation in the following way: “Poland shares a number of weaknesses with other emerging economies as an investment destination: low stocks of quality physical capital and know-how, an underdeveloped services

³ Inward FDI flows to GDP (%) figures for Poland for the period 2000-2012, downloaded from http://www.unece.org/stats/stats_h.html on 18/09/2013

sector, and a relatively weak institutional structure”, as well as some strengths, such as “membership in the EU, a well-educated and relatively inexpensive labour force, and strong commercial links with the markets of both the former Soviet Union and the EU”. Therefore, among other CEECs, it seems to be a useful platform to observe the effects of getting involved in networks for firm-level upgrading.

1.2.2 Low- and Medium-Technology Industries: Food-Processing⁴ and Clothing

This thesis empirically investigates the networks of two traditional industries, namely food-processing and clothing, to answer the above research questions. The OECD classification of industries on the basis of their technology content as low, medium and high-tech categorises these industries, which have historical significance in economic development of today’s advanced countries, as “low-tech”. A growing literature on low- and medium-technology (LMT) industries emphasises the still ongoing importance of these industries not only in developing countries’ economic development but also in advanced countries’ economies (Von Tunzelmann and Acha 2005, Hirsch-Kreinsen 2008, Freddi 2009). Food-processing and clothing industries are staple industries with a high share in total manufacturing output in nearly every country, and were a major source of industrialisation particularly in the early stages in a number of West European countries, like the Netherlands, Denmark and Switzerland for food-processing, and Italy, Spain, and Portugal for clothing industry (von Tunzelmann 1995). Despite the shift of attention to high-tech industries, statistics substantiate that these industries are still the main engine of industrialisation in most of the developing countries. The emerging markets of CEE (of concern in this study) are no exception. In addition, with the shrinkage of LMT industries in Western Europe, firms are relocating to CEE (Heidenreich 2009), a phenomenon that not only alters the dynamics of these industries but also influences the pace of change.

Von Tunzelmann and Acha (2005) stress the need to develop more suitable classifications for traditional industries rather than low-tech, labour-intensive, supplier-dominated, and so on, which miss the recent technological developments in these industries. Food-processing has proved to be an evolving industry with increasingly

⁴ The general information about the food-processing industry is partly extracted from various works of the author on this industry (von Tunzelmann and Yoruk 2004, Yoruk 2003, Yoruk and von Tunzelmann 2001).

capital-intensive technology (particularly in the West, though to a lesser extent in Eastern Europe), providing impetus for growth (von Tunzelmann and Charpiot-Michaud 2000). Its role as an important ‘carrier industry’ for new technologies is easy to overlook. In response to changing consumer demands (from globalisation of tastes, higher incomes and mobility, increasing female employment, increasing work pressures, ageing populations, greater demands for environmentally-friendly products, etc.), the industry has had to change radically over the past twenty years. This has been met by firstly a resort to a wide range of new high technologies that are not directly targeted food-processing industry (e.g., pharmaceuticals, biotechnology, new materials, advanced instrumentation, scientific advances in maths, physics, chemistry, etc.) (Christensen *et al.* 1996, Bijman 1996, von Tunzelmann and Charpiot-Michaud 2000, Alfranca *et al.* 2004), and secondly radical organisational change with the penetration of automation into production processes and ICTs in the form of LANs and Internet services, which is a relatively recent phenomenon in the Polish food-processing sectors. In the clothing industry, although since the 1980 microelectronics had strong influence in the re-organisation of the relationships between the actors within the industry in developed countries (Whitaker and Rush 1987, Godinho 1993), it was only in the 1990s that ICTs came to constitute one of the key factors in organisational changes in the clothing firms.⁵ There is an observable impact of new technological paradigms like ICTs on both industries, but this appears more muted than the demand side opportunities (Yoruk and von Tunzelmann 2006). In addition, as noted by Ernst and Lundvall (2000), ICTs become a flexible tool supporting interactive learning, particularly in networks (also Ernst 1997, 2000b, 2006).

The abovementioned technological developments do not change the fact that LMT firms do not carry out much of their innovation ‘in-house’, which eliminates them from

⁵ ICTs help firms to cope with uncertainties through introducing flexibility into production and organisational processes; for instance, by facilitating the production control within the organisation (among operator, technicians and management) through systems like computerised standard data systems, cut planning, real-time communication systems, computerised unit production systems (i.e. automatic routing of garments and pieces between workstations via conveyors), manufacturing resource planning systems (MRP II), and automatic warehouse systems. Some other typical changes within the functions of the firm are in supply chain management (control over logistics and agents by means of IT), in design (use of CAD), in manufacture (flexible manufacturing systems and CIM), in marketing (computer-controlled inventory and stock management, MRP and MRPII), accounting and management (computers for administrative purposes). Also, at the administrative level, they have eased the information transfers between the actors in the value chain (i.e. the supplier, the producer and the distributor) through electronic data interchange (EDI) (Yoruk and von Tunzelmann 2006).

the R&D intensive industry categories (Heidenreich 2009). However, at the same time, the association of low innovativeness with low technology is also not relevant anymore (Hirsch-Kreinsen 2008). Von Tunzelmann and Acha (2005) argue that many traditional industries that are labeled as ‘low-tech’ are not anymore true ‘low-tech’ sectors when this increasing permeation of high technologies into LMT industries are considered. They also stress the enlarging technological opportunities for LMT industries through the presence of search and use of knowledge and technology in the innovation of ‘non-manufacturing’ activities of LMT industries, such as branding, marketing and distribution (see also Green *et al.* 1996). They illustrate how supply (technology) and demand (product) aspects are combined in LMT industries by using the examples of textiles and clothing and food-processing industries.

The links of food producers with industries such as biotechnology, pharmaceuticals (e.g., to develop special vitamins that are not destroyed at high temperatures) and advanced materials (whose use in the packaging industry has generated product innovations, especially in the cases of frozen food-processing and ready-made products) have not only mitigated the backwardness of the food-processing industry with regard to lack of in-house R&D but also brought the need for collaboration with other firms and industries, encouraging horizontal spillovers of technological know-how (von Tunzelmann and Yoruk 2004; see also Galizzi and Venturini 1996, Alfranca *et al.* 2004, von Tunzelmann and Charpiot-Michaud 2000).⁶ Therefore, it would be more appropriate to characterise it as a ‘multi-tech’ industry (Granstrand *et al.* 1997) than as a ‘low-tech’ one, with an increasing bias towards adoption of advanced areas of technology. Significant effects of being a multi-tech industry are most importantly observable in product innovations in the food-processing industry. They can be new products⁷ or depend on the use of new ingredients⁸, in recent decades mostly adapted to the changing demands of the consumers in alignment with the changes in process

⁶ For instance, the modification of milk to produce healthier butter is a matter of choice among various available techniques, including the physical, the chemical, the biotechnological, or the agricultural techniques (e.g., changing the feed of the cows). These techniques are integrated into the processing techniques in the food-processing industry, in cooking, pasteurization (UHT milk), in freezing, in production integration and in packaging.

⁷ These new products are more exotic foods such as ready-made dishes; more prepared foods such as sauces, microwave food; more casual food such as snacks; healthier food such as low calorie, low fat food (Christensen *et al.*, 1996).

⁸ Examples of new ingredients include the substitution of natural for artificial ingredients (replacement of E-number additives with more nature-identical flavourings) and the replacement of ‘bad’ ingredients (protein alternatives to fats, alternatives to sugar) (Christensen *et al.*, 1996).

innovations (Blanchfield 1983). These become product innovations that lead to improvements in the market positioning of the firm. They mostly depend on rising incomes (products for higher income earners), homogenization of tastes (e.g., demand for ethnic food – products for new users); rising employment of married women (e.g., ready-made meals – products for new uses); increased pressure and stress in life (e.g., snacking); and the restructuring of tastes in the world due to global competition for market share among producers (Coca Cola, McDonald's, etc.). Use of advanced packaging technologies has led to new product innovation by means of meeting consumer demands for (i) ease of use (e.g., ring-pull cans and tear-strip openings), (ii) new eating habits (as for ready meals), (iii) food-processing safety (e.g., avoiding the 'migration' of packaging into the product), (iv) environmental friendliness (e.g., avoiding non-biodegradable and wasteful packaging) (for details see Christensen *et al.* 1996).

As for the clothing industry, for decades there have been efforts to automate its production process to alleviate high labour costs in developed countries. Full automation of all production stages is hard to achieve, particularly in the case of sewing, which is a combination of experienced labour with technologically improved machinery.⁹ There are stages in clothing production where advanced technologies with full or partial automation are effectively in use: in the pre-assembly stage, where design, grading and marking of patterns are executed with computer-aided design software (CAD), in the assembly stage in cutting (first introduced in the 1970s), and in finishing. However, the labour-intensive characteristics of the clothing industry remain, as the one-machine / one-operator configuration of the sewing stage has not been altered. Therefore, CEECs have become the focus of West European clothing firms in manufacturing, which makes them attractive for becoming a part of the global supply chains.

⁹ It is known today that the efforts of textile machinery suppliers during the 1980s by Japan, West European countries and the US to develop full automation in the clothing industry were not successful. Several projects in Japan, the US and Europe have ended up with other modest but generally useful innovations like automated seaming (Byrne, 1995) and specialized machinery like automated buttonholing or collar sewing. When CAD is considered as pre-assembly stage where design, grading and marking of patterns are prepared, the only fully automated segment in the assembly (manufacturing) stage is cutting (first introduced in the 1970s).

Clothing firms greatly benefit from the innovativeness of upstream machinery and equipment producers, and can thus be considered to be supplier-dominated (Pavitt 1984). Process technology has profited from innovations in quality control¹⁰ and in pre-assembly stage of manufacturing.¹¹ In the sewing department, the innovations are rather incremental enhancements that are focused on sewing machines. They have adapted to electronic controls and optoelectronic sensors. There are three types of sewing machines: basic machines, special purpose sewing machines and multi-purpose machines (Godinho 1993). Moreover, overhead conveyors, especially used by shirt producers, have been computerised. Finally, there are some enhancements of the machinery in the final stage of the assembly, namely finishing, which covers pressing, ironing, final quality inspection and packaging. These enhancements might be in pressing machines, in packaging, or in a stage between inspection and packaging, depending on the needs of the segment of the clothing industry.

Product innovations in the clothing industry come from the textile producers that introduce new fabrics and threads with special specifications (e.g., waterproof, easy-to-care, no-iron fabrics) in cooperation with other industries such as chemical industry. These innovations in the textile industry do not derive from extensive R&D in the industry but more from the application of the results of research undertaken in other applied sciences. Constituting one of the non-manufacturing activities of the firm, design, requires creativeness in its own right and generates much of the value-added in the industry. Primarily, design capabilities are embedded in designers rather than the firm itself. Thus design capabilities gradually become a distinguishing feature among the clothing companies that precedes functional upgrading. In general, the competitive edge of the industry now lies in the design of the garments; however, this is also in concert with the developments in the upstream textile industry. In the last decade developments in the global retail industry also paved the way for development of capabilities in this industry for organisational innovation in branding, marketing and distribution. As a result, from a technological viewpoint, low- and medium-technology industries appear to be more useful than high-tech sectors for this research.

¹⁰ E.g., colour matching of fabrics arrived from textiles suppliers.

¹¹ E.g., CAD in design and in grading, marking and laying of patterns, which decreases the costs as it makes it possible to work out the samples on the computer and makes maximum use of the fabric.

1.3 THE THEORETICAL POSITIONING

This research aims to expand our understanding of learning in networks and its impact on firm-level upgrading by filling the specific gaps in the upgrading literature. Its starting point will be the two frameworks on which the upgrading literature has primarily relied, namely global production networks (GPNs) and global value chains (GVCs). Then it will build on the literatures that are inspired by the evolutionary perspective, in which among other things knowledge networks, technology transfer, learning, spillovers and competence-building are stressed.

Network scholars consider networks with external agents as a potential source of learning (Powell *et al.* 1996, Uzzi 1997) as well as facilitators of learning by promoting efficient skill transfer among firms (Hamel 1991). This way, networks become a tool for upgrading for emerging-market firms on the proviso that they learn from their relationships, especially when they “are particularly well suited for rapid learning and the flexible deployment of resources” (Powell and Brantley 1992: 389). Networks come to life in connection with systems; the GPNs and GVCs that the upgrading literature focuses on stem from production systems. Recent efforts in theorising GVCs have depicted them as networks in the sense of transaction cost economics - i.e., an intermediate form of governance between markets and hierarchies located within the boundaries of value chains (Schmitz 2004, 2006; Gereffi *et al.* 2005).

This research expands the focus to knowledge systems with the aim of highlighting the significance of knowledge acquired from organisations outside the production systems, as compared to those inside the production systems.¹² Knowledge systems have been important to understand the technological dynamics of developed countries, while there is only limited empirical research about how knowledge networks emerge and evolve in the specific context of large firms in developing countries and in transition economies (Bell and Albu 1999). So, this research considers networks established within both production and knowledge systems as the external sources of firm-level upgrading.

Learning in networks that are embedded in different systems is expected to have different impacts on the improvements in the competencies and competitiveness of the

¹² Organizations used in this thesis include firms, universities, research institutes, training centers, consulting firms, business associations and the like (Edquist and Johnson 1997).

firms (Bell and Pavitt 1993, Hobday 1995, Bessant and Francis 1999). Hence, the question of *how* networks play a significant role in an emerging market firm's upgrading is hidden in 'learning in networks', à la Håkansson *et al.* (1999: 443), who explain it in the simplest form as "learning directly from others", which "means the transfer of knowledge embedded in products or processes or the transfer of knowledge in a more pure form".

Although the upgrading literature attaches significance to learning as a crucial part of the upgrading process, the discussion does not go beyond 'learning by exporting' and 'learning by doing', and the dynamics of learning have not been sufficiently examined as it is taken as granted. On the one hand, it is not easy to capture in the empirical studies on GVCs/ GPNs either the underlying factors affecting learning external to the firm or how this particular learning affects firm-level upgrading. The available empirical work focuses on the firm's willingness to learn and the assessment of local firms' capabilities by global buyers, in order to explain 'learning-by-exporting' to the latter (Gereffi 1999a, Schmitz and Knorrington 2000, Bazan and Navas-Aleman 2004, Schmitz 2006, Navas-Aleman 2011, Özatağan 2011). The upgrading literature acknowledges only 'learning by doing' that derives from production practices within the value chains or production networks. This, I argue, is too a narrow approach to the sources of upgrading within the firm.¹³

The shortcomings of this narrow approach might be related to the foci of the upgrading studies undertaken so far. First the focus has been on the outcome of 'industrial' upgrading by looking at firms, rather than 'firm-level' upgrading as the outcome by looking at the relationships of the firm (i.e. an issue of unit of analysis). Second, the focus has never been on the 'knowledge transfer' between cooperating firms in the value chain but on the 'governance' in the value chain and its assumed learning effects on the upgrading of the emerging country firms, resulting from the experience of doing production for export markets. This is a simplification which can be rather misleading. Such learning captures only "the information flows that are generated by the activities of buying, producing and selling" (Fransman 1986: 41).

¹³ The case studies that use the GPN framework and elaborate learning, knowledge transfer and diffusion in more detail, mostly in the work of Ernst, have in recent years extended into global knowledge and innovation networks.

Therefore, the integration of other literatures into the upgrading literature is useful and enriching for analytical purposes. Upgrading should not be limited to GVCs / GPNs; it locates itself in any context, in any literature.¹⁴ So, it is analytically misleading to bring all network types under the umbrella of value chain-based governance structures. On the one hand, still missing from the analysis of learning in GVCs/ GPNs are tools that can represent networking relations that transfer knowledge and create learning opportunities while free from governance. On the other hand, the network literature elaborates learning in networks in developed countries and high-tech industries.

This thesis suggests an ‘evolutionary approach’ to upgrading which incorporates non-hierarchical, non-linear networking relations with higher opportunities for learning capabilities into the upgrading concept. This approach continues to make use of the GVC / GPN frameworks in the upgrading literature, but claims that they are insufficient to cover the whole story, not only on their own but also together, and that they therefore have to be complemented with other elements, such as ‘knowledge systems’ (Bell and Albu 1999) as well as ‘production systems’, other learning mechanisms (Malerba 1992) complementing learning-by-doing, and strategies for competence-building alongside competitiveness enhancement (Hamel 1991; Prahalad and Hamel 1990). So, the network theories of the firm that view networks as sources of knowledge and learning, and the learning literature that clarifies inter-organisational and intra-organisational learning mechanisms, are used in order to develop a dynamic model of firm-level upgrading.

As a result, this research attempts to examine empirically learning mechanisms in networks and the way they contribute to the types of firm-level upgrading. In general, learning in networks is about developing the ability to identify and acquire new, potentially useful and valuable external ideas and knowledge while in a relationship and to assimilate this externally acquired knowledge within the firm. Having access to an external source does not necessarily mean the firm is capable of recognizing the vital knowledge (i.e. learning might not occur although there is access to a knowledge

¹⁴ It has applicability in MNC-subsidiary relations (i.e. international business literature), in market-based relations (i.e. neoclassical economics), and in networks, irrespective of the value chain framework (e.g. Zander 1999; Dulleck *et al.* 2005).

source). Similarly, recognizing the importance of external knowledge while having access to it through networking does not necessarily mean the firm can assimilate it (meaning complementary internal factors such as learning mechanisms internal to the firm and knowledge sharing mechanisms within the firm may not be developed). The association of learning, in the broader sense as it is understood here (i.e. inter-organisational and complementary intra-organisational learning), with firm-level upgrading has not received the kind of attention it deserves from those researching upgrading.

This thesis aims to provide a framework that relates learning in networks with firm-level upgrading by distinguishing varieties of networking activities of the firm within different systems *and* by unpacking learning mechanisms external to the firm with particular interest in learning that takes place in a relationship. To do so, this research proposes to make use of Malerba's (1992) 'learning mechanisms external to the firm' to bridge the gap between networks and upgrading in the literature. It is a plausible candidate for overcoming the empirical deficiencies of the upgrading literature with regard to the learning concept and its connection to networks. Learning external to the firm (as reflected best in knowledge transfer processes) is complemented by internal learning mechanisms and knowledge sharing processes.

As a result, the observed outcome of learning in this research is in the upgrading of a product, process, function or managerial activity in the firm. For operationalisation purposes this study adopts Humphrey and Schmitz's (2004a) typology of upgrading with some changes and adaptations, where process, product and functional upgrading are kept but inter-sectoral upgrading is withdrawn due to its irrelevance to the scope of this research, for reasons of the geography and time period concerned, while a new, often overlooked and indeed even forgotten, category is added: that of managerial upgrading.

1.4 THE RESEARCH METHOD

The conceptual framework of this thesis is tested with data collected from large domestically owned firms operating in the food-processing and clothing industries in Poland. Existing research on how learning takes place within GVCs/GPNs is limited largely to case studies. This research constitutes an effort to depart from what has been

done so far in favour of empirically based research that relies on a dataset created through in-depth face-to-face interviews with firms. After a sampling strategy supported by a pilot questionnaire survey, I arrived at a final sample composed of 8 food-processing and 8 clothing firms, with 467 relationships in total. This research employs a unit of analysis novel to the upgrading literature - the relationship of the firm - which will help joint analysis of production and knowledge networks as sources of firm-level upgrading. All the firms in the sample are large brand manufacturers in the home market, with more than 500 employees.

The fieldwork consisted of two visits to Poland in May and November 2001.¹⁵ Two types of interviews were conducted: Semi-structured, targeting leading individuals in the core firms who were responsible for and knowledgeable of the relationships the firm was involved in (managers at top and intermediate managerial levels), and open-ended, targeting researchers in nine public and private organisations / partners. Interview material was triangulated with secondary information consisting of site observation, documentation related to the companies, interviews with researchers, etc., as well as secondary sources such as business magazines, journals, newspapers, and the Internet. Structured conversations during factory visits that were held with senior engineers and other employees were a useful technique of double-checking the information received from the managers. Online resources provided general information about company operations before the interviews and were used as background information for a well-prepared interview with the respective firm.

The efforts of research on firm-level upgrading by means of GVCs are limited to case studies, rather than statistical evidence. The methodological contribution of this thesis is that from the very beginning, the research was designed for statistical data analysis of the qualitative information collected through in-depth interviews, which will allow generalisations, reliable and robust conclusions. Interview questions were designed to yield answers that could be formulated as categorical variables, thus forming a dataset that could be subjected to quantitative data analysis methods, such as multinomial logistic regression analysis.

¹⁵ My fieldwork was financed by the ESRC project entitled 'The emerging industrial architecture of the wider Europe: the co-evolution of political and economic structures' and coordinated by Prof. Slavo Radošević in School of Slavonic and East European Studies at University College London, where I was a research assistant during 2000-2002.

A micro level research model was created with the main assumption that firms involved in networks that transfer knowledge have cooperative strategies. It was comprised of two levels of analysis: inter-organisational and intra-organisational, in accordance with the literatures used. The former uses ‘learning mechanisms external to the firm’ as the dependent variable to examine the impact of characteristics of the relationship, the partner and the knowledge transfer during a relationship. The latter refers to the internalisation of the externally acquired knowledge through internal learning and knowledge sharing between the knowledge-acquiring individuals and other employees within and between units in the organisation of the firm.

The analysis covers the period 1989-2001, which is divided into three sub-periods on the basis of key political and economic changes that occurred during the period. The breaking points between the periods are, first, the return to an appreciable rate of growth in the Polish economy in 1993 (following the initial transformational recession), and second, the Russian crisis in 1998, which influenced the trade performance of the firms in Poland. The time periods are, therefore, 1989-1993, 1994-1997, and 1998-2001.

1.5 STRUCTURE OF THE THESIS

This thesis consists of nine chapters. Focusing on the literature survey on upgrading, Chapter 2 covers two contexts the upgrading literature has grown out of in detail, namely GPNs and GVCs. The chapter also reviews the definitions and operationalisation of the upgrading concept found in the relevant literature. Then, it discusses the limitations of the upgrading literature with regard to networks, learning and firm strategies. Chapter 3 develops the conceptual and analytical framework of this thesis to systematically analyse the upgrading concept within the boundaries of ‘learning in networks’. It sets the theoretical background for the tools of analysis (networks, learning and learning in networks), defines and operationalises the concepts that are the cornerstones of the conceptual framework (upgrading and networks), and then links these concepts within a framework that builds the basis for research methodology.

Chapter 4 provides the research methodology by describing the research models and the research design (rationale for the choice of industries, means of comparison, sampling

strategy and the sample of firms, data collection methods, the dataset of relationships and its reliability, and the unit of analysis). It also describes how the time dimension is tackled for a dynamic analysis. Then the chapter introduces the measures and variables used and their operationalisation. Before concluding, it discusses the data analysis methods in detail.

Chapter 5 is about the context in which this research is undertaken. It discusses the structure of the Polish economy (growth, macroeconomic indicators, foreign trade, privatisation, FDI and enterprise restructuring) and Science and Technology (S&T) in Poland. It also provides information about the innovation activities of Polish companies, with specific emphasis on the LMT industries studied, - food-processing and clothing.

A descriptive chapter (Chapter 6) will attempt to map networks in Polish food-processing and clothing firms based on the dataset created as a result of the interviews conducted. It also presents the initial observations from my fieldwork through an exploratory analysis of network and partner types using crosstabulations and chi-square tests. This is followed by two analysis chapters of a rather technical nature. They (Chapters 7 and 8) employ multinomial logistic regression (MLR) as a statistical method to identify and differentiate the key factors underlying the relationships between networks and learning and between learning in networks and firm-level upgrading. MLR models are built in order to find out what characteristics of networks play a role in learning in networks (Chapter 7) and what the network-related sources of the types of firm-level upgrading are (Chapter 8).

Chapter 9 concludes, makes a link with theoretical findings, provides policy implications, and discusses the theoretical, empirical and methodological contributions to the literature. Six appendices are found at the end of the thesis. Appendix A provides information about Gereffi's (1999a) sectoral taxonomy with regard to governance and Appendix B is a review of the network theories of the firm. Appendices C, D and E present the pilot questionnaire and the interview questions used during face-to-face interviews in the firms and in the organisations. Appendix F presents the original tables related to the analyses in Chapters 6-9 which are collapsed down to more focussed tables in the texts. Appendix F.1 explains the use of multiple correspondence analysis for data reduction purposes.

Chapter 2 UPGRADING LITERATURE AND THEORETICAL FRAMEWORK

2.1 INTRODUCTION

This chapter first reviews the upgrading literature in GVC and GPN frameworks, discussing the similarities and differences between them with regard to the way they deal with the concepts of networks and learning through networking activities of the firm (section 2.2). This discussion includes a brief review of the limitations of the upgrading literature with regard to each concept.

Then the chapter introduces the theoretical framework of this research. Since the main focus of this research is on the mechanisms of knowledge transfer and learning through networks as a source of knowledge in emerging market firms, it makes use of learning mechanisms external to the firm as a bridging concept between networks and firm-level upgrading. Hence, it reviews two underlying and complementary literatures to the upgrading literature; namely, the network theories of the firm and the literature on learning from an evolutionary perspective (section 2.3). Section 2.4 concludes the chapter.

2.2 UPGRADING LITERATURE

This section overviews the background literature on upgrading. Globalisation is the backdrop for the development of the upgrading literature, due to its role in the fragmentation of value chains and delocalisation of production activities beyond the boundaries of the firm and across national borders. Three streams of literature simultaneously provide complementary insights on factors influencing ‘upgrading’ by focusing on the international de-localisation of production and global integration underway since the late 1990s. One of these streams is the industrial organisation literature which developed the concept of *global production networks* (GPNs) and a framework that emerged with the shift in industrial organisation from internal structures of the ‘modern corporation’ of Chandler (1977) to the external economies created by interactions among firms that are located in the global economy (Sturgeon 2002), and as a result, rely on the disintegration of an industry's value chain into constituent functions (among others, Zysman *et al.* 1997; Ernst 1997; Borrus *et al.* 2000, Berger *et al.* 2001). Hence, GPNs have roots in organisational forms such as outward processing (OPT),

Original Equipment Manufacturing (OEM) and contract manufacturing (CM), and are mostly associated with multinational corporations (MNCs), which established and governed these forms of networks overseas. This literature uses GPNs to understand the implications of development paths created by such organisational forms for the host countries as well as the industries and firms in these countries.

Another literature that deals with ‘upgrading’ is the Global Value Chain (GVC) literature that stems originally from the ‘global commodity chain’¹⁶ (GCC) concept (Gereffi and Korzeniewicz 1994), which evolved into GVC analysis with contributions by Kaplinsky¹⁷ and other development economists (section 2.2.3 discusses the latter’s contribution to upgrading literature in detail).¹⁸ Kaplinsky and Morris (2002) describe the simple value chain as “the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use”¹⁹; one can imagine a vertical link between design, production, marketing and consumption. Referring to real-world practices, GVC scholars do not exclude the extended value chains that include more links, such as non-market coordination of activities in the value chain through inter-firm relationships and institutional mechanisms (Gereffi *et al.* 2005). They differ from scholars of GPNs with respect to their interest in the hierarchical relationships between global buyers (as the lead firm in the GVC) and local suppliers (i.e. governance

¹⁶ In the mid-1980s, a commodity chain was defined by Hopkins and Wallerstein (1986) as “a network of labor and production processes whose end result is a finished commodity”, with the emphasis on processes. Gereffi and Korzeniewicz (1994) extended it into ‘global’ level and define a global commodity chain as “sets of inter-organizational networks clustered around one commodity or product, linking households, enterprises, and states to one another within the world economy”. A brief history of commodity chains by Dyker and von Tunzelmann (2002) shows that the concept dates back to pre-industrial times.

¹⁷ Kaplinsky (2000, also Kaplinsky and Readman 2001) has made a contribution to Gereffi’s work in explaining why ‘commodity’ is not the right word to use in the global chain and ‘value chain’ covers real world systems, whose origins are in French *filière* better. Although Kaplinsky has drawn on the GVC framework in his analysis, he is distinguished from other authors on upgrading in developing countries by his emphasis on income distribution and the inequalities imposed by globalisation. His work is not related to ours in that respect.

¹⁸ Gereffi (1994) explains global commodity chains as rooted in production systems. They allow firms to develop, manufacture, and distribute specific commodities through linking firms’ economic activities to technological and organisational networks. He claims that the novelty of GCCs lie in the geographical spread of transnational production arrangements and in their organisation by industrial and commercial firms through linkages between various economic agents, not only at the national but also at the global level (Gereffi 1994 and 1995).

¹⁹ Porter (1990), who considered the national competitive advantages with respect to value chains, defined the value chain as including the stages of supply, production and the support services.

in GVCs as the central theme in the GVC literature) and the implications of those relationships for the local supplier's development (i.e. upgrading).

More recently, Baldwin (2011, 2012) has contributed with his analysis of the functioning and economics of global supply chains. He focuses on the functional unbundling of production processes into finer stages of production that is governed by a trade-off between specialisation and coordination costs (i.e. fractionalisation) and on the geographic unbundling of the stages of production due to wage gaps between North and South and firm-level excellence (i.e. dispersion), with specific emphasis on the role of the ICT revolution in enabling the coordination of such complex industrial organisations (Damijan *et al.* 2013). Baldwin (2013) also highlights the measurement problems regarding global supply chains, because now both the exports and imports of products have become a concern. He stresses the interconnectedness of *trade in goods* (especially parts and components), *international investment in production facilities* (including training, technology and business relationships), the use of *infrastructure services* to coordinate the dispersed productions (especially services such as telecoms, air cargo, trade-related finance, customs clearance services, etc) and *cross-border flows of know-how* (such as formal intellectual property, managerial and marketing know-how) and calls it trade-investment-services-IP nexus. In general, Baldwin's (2011, 2012) analysis of global supply chain (GSC) economics takes an approach to knowledge transfer between global buyers and their emerging market suppliers that is similar in many respects to that of GVC scholars. However, it differs by highlighting 'technology lending' by the global buyer (or lead goose as in flying geese model of Akamatsu; see Kojima 2000) to emerging market firms rather than 'technology transfer' that eases the global buyer's move to a lower-cost country.

The third stream of literature is one in the area of economic geography, pioneered by Dicken (1992), who has shown the earliest insights into the origins of GPNs, and which focuses on the impacts of GPNs on economic / regional development, including the role of non-firm institutions and other network configurations (Henderson *et al.* 2002, Coe *et al.* 2004, Hess 2008, Coe *et al.* 2008). Particularly the economic geography researchers "in Manchester and their collaborators" (see, e.g., Henderson *et al.* 2002, Dicken and Henderson 2003, Coe *et al.* 2004) focus on developing a GPN framework that systematically differentiates it from the GVC approach, although they have combined

GPN analysis “with insights gained from GCC/GVC analysis with ideas derived from the actor-network theory (ANT) and varieties of capitalism/business systems literatures” (Coe *et al.* 2008: 267). Unlike the GVC framework, the GPN framework is used by these scholars to understand the impact of complex processes, power, value and embeddedness in production systems and changing inter-relations in the global economy on regional development and clustering dynamics. Although Manchester researchers have not been interested in the role of GPNs in ‘upgrading’, there are economic geographers who used the GPN framework to understand the dynamics of upgrading in various industries in the CEECs (e.g., Smith 2003, Pickles *et al.* 2006, Smith *et al.* 2008, Özatağan 2011).

The definitions of upgrading in the literature are varied. As will be discussed in detail below, they are all originally located within the boundaries of production systems/networks. Moreover, each of the contributors has focused on a different dimension of upgrading. Common to all of them is their interest in *hierarchical* improvements with regard to these dimensions, i.e. shifting from one stage or position to another as upgrading takes place. The upgrading concept has evolved around the idea of improvements from worse to better, from low to high, from shallow to deep, and so on. As a result, both definitions and operationalisation of the concept have, thus far, been based on this hierarchical change from low to high ‘value-added’ (in relation to value chain). The major contributions in defining and operationalising the upgrading concept are assessed below.

This section will review the approaches within which upgrading is defined and operationalised, i.e. GPNs and GVCs. It is structured as follows. It first discusses the definitions of upgrading with regard to its origins and recent developments as well as efforts to operationalise the concept. It will then present the literatures on global production networks (GPNs) and global value chains (GVCs) in which industrial upgrading (IU) is addressed. In particular, the distinguishing characteristics of these literatures in the development of the upgrading concept in developing countries will be discussed. Finally, a summary of the literature review of upgrading will be provided.

2.2.1 Upgrading through Global Production Networks

2.2.1.1 Global Production Networks²⁰

In this research, the GPN approach to IU is reviewed in the light of the contributions of Ernst, whose work on the East Asian GPNs in electronics and ICT industries has shaped the IU concept for almost twenty years. Ernst (1997, 2006) defines a GPN as the set of relationships among firms that organise all the activities within the value chain of a given industry *across* national borders; these may or may not involve equity ownership. These activities do not encompass only production, but instead range from procurement, outsourcing and support services to sales and marketing/distribution, engineering, design and R&D activities. This is the *scope* characteristic of GPNs (Ernst 2006).²¹ Similarly, economic geographers who use the GPN framework extensively in their research define GPNs “as the globally organised nexus of interconnected functions and operations by firms and non-firm institutions through which goods and services are produced and distributed” (Coe *et al.* 2004: 471).

Arguing that “in reality, each stage of a production chain is embedded in much wider sets of non-linear/horizontal relationships”, Coe *et al.* (2008: 274-275) prefers to view GPNs as “an organisation of international production and an international dimension of business networks”. This in fact creates a complex, multitier ‘network of networks’ within production systems; as will be discussed below, this sets the construct apart from Gereffi’s linear value chain, Sturgeon’s modular production network model or Berger *et al.*’s type of production networks with limited focus on OEMs and CMs. As in the latter, GVC-based, conceptualisations, though, the lead firm exercises control over the network resources and decision-making. Its strength comes from the intellectual property and know-how associated with setting, maintaining and continuously upgrading a de facto market standard. This is the *asymmetry* characteristic of GPNs (Ernst 2006).

²⁰ The concept has evolved from different terms such as cross-border production networks, transnational production networks, and international production networks to global production networks and has continued to evolve into new conceptualisations under names such as global knowledge networks (Ernst 2006) and global innovation networks (Ernst 2009). This research will use the term GPNs and the literature related to it.

²¹ Ernst (1997) explains the reason behind this broad definition of production in GPNs as an attempt to avoid some of the shortcomings that result from a narrow analytical focus in manufacturing only (covering from component production to final assembly) that excludes non-manufacturing side of production (including knowledge-intensive activities such as marketing, standardization, product design, the development of production technology, generic technologies, and scientific knowledge).

Ernst (1997, 1998, and 2001) distinguishes five types of GPNs that range from intra-firm (subsidiaries, affiliates, joint ventures) to inter-firm relations (subcontractors, suppliers, service providers, distribution channels and partners in strategic alliances) while at the same time maintaining a *firm-level* perspective to identify some of the forces that determine GPNs:

- (i) *Supplier networks* include subcontracting, consignment assembly, original equipment manufacturing (OEM), original design manufacturing (ODM), contract manufacturing, and turnkey production between a client and its suppliers of intermediate production inputs;
- (ii) *Producer networks* “include all co-production arrangements that enable competing producers to pool their production capacities, financial capabilities, and human resources in order to broaden their product portfolios and geographic coverage” (e.g. between the two biggest Polish clothing firms Vistula SA and Wolczanka SA in Poland before they merged, see Yoruk 2002a);
- (iii) *Customer networks* “include forward linkages of manufacturing companies with distributors, marketing channels, value-added resellers, and end users, in order to facilitate the penetration of existing markets or the development of new markets”;
- (iv) *Standards coalitions* “are initiated by potential global standard setters with the explicit purpose of locking-in as many firms as possible into their proprietary product, architectural, or interface standards”;
- (v) *Technology cooperation networks* include bi-directional flow of knowledge among partners who “master a fairly broad array of technological capabilities” through “exchange and joint development of product design and production technology, cross-licensing and patent-swapping, and sharing of R&D” (Ernst 1997:34).

In the last type of GPNs lies the *knowledge sharing/diffusion* characteristic of these networks (Ernst 2000a, 2001, Ernst and Kim 2002), which “is the necessary glue that keeps these networks growing” (Ernst 2006:165).²² In Ernst’s work with evolutionary insights (2006, 2008, 2009), this approach has over the years evolved from GPNs to global knowledge networks and global innovation networks in the context of emerging markets (i.e. in East Asian electronics industry).

²² Here, Ernst attempts to capture the technology side of production activities as well as to integrate the knowledge sharing/ diffusion / creation aspect of networks, as discussed in the evolutionary school. However, it is more plausible to associate technology cooperation networks with knowledge networks than GPNs (see Table 3.1 in section 3.2.2).

There are contributions by Berger *et al.* (2001) and Sturgeon (2002) to developing taxonomy for GPNs; namely, the *captive* production network, the *relational* production network, and the *turn-key* production network.²³ Sturgeon (2002) also coined the term *modular production networks*, based on the widely accepted standards that enable the codifiable transfer of specifications between firms and create an ‘openness’ which allows the system to build-up thick tacit linkages between stages in the value chain. This, he claims, has allowed for reduced interdependence between partners by bringing performance advantages in the form of ‘organisational flexibility’ compared to the captive, relational or turn-key production networks. The approaches of Berger *et al.* (2001) and Sturgeon (2002) to GPNs are more influenced by the governance issues and modularity than the approach of Ernst and economic geographers, and hence the governance theory of GVCs, as later developed by Gereffi *et al.* (2005), encompasses these types of GPNs.

2.2.1.2 Key Features of Upgrading in GPN Framework

Early studies on GPNs highlighted the importance of being integrated into GPNs for the emerging market firms (Borrus 1997, Zysman *et al.* 1997, Zysman and Schwartz 1998, Linden 1998, Eichengreen and Kohl 1998, Henriot and Inotai 1998, Guerrieri 1998, Graziani 1998, Comisso 1998, Borrus *et al.* 2000). Ernst (1998) has systematically furthered the analysis of upgrading based on the evolution of the electronics industry and its strong reliance on GPNs. He sees IU as an attempt to model the link between innovation, specialisation and Hirschman-type linkages (‘industrial deepening’) that needs to be complemented with local knowledge creation (Ernst 2001, Hirschman 1958). In this model, he includes the firm itself, its relationship with other organisations, and also government policy as sources of innovation and growth. Ernst (1998, 2001) puts forward four distinguishing features of IU: 1) Use of a *broadier definition of innovation* which covers not only R&D and patenting but also engineering, technology purchases, expenditures on licensing and consultancy, and technology search, as well as the accumulation of tacit knowledge required to absorb imported

²³ *Captive* production networks refer to tiers of ‘captive’ suppliers that are coordinated by a few lead firms as their customers (e.g. production networks of Japanese firms). *Relational* production networks refer to the spatially and socially dependent relations between firms (e.g. industrial districts, regional networks, clusters, etc.). *Turn-key* production networks refer to the capabilities of highly specialised suppliers that provide a wide range of services without instructions to a large group of customers (e.g. production networks of American firms).

technology;²⁴ 2) referring to IU as *a context-specific concept* whose characteristics differ across industrial sectors and countries; 3) the possibility of a vicious circle of *truncated IU*; and 4) the focus on the *co-evolution of industry structure and firm behaviour* as a result of the consensus in the evolutionary school that industry structure is insufficient to explain the dynamics of innovation and that firm behaviour (including organisation and strategy) has an important bearing on the intensity and variety of innovation activity (1998, 2001). Therefore, upgrading in his definition becomes a function of technological and organisational innovative capability development within the firm and knowledge transfer within the industry structure, which differs across industries and countries, with a possibility of downgrading.

In operationalising the concept, Ernst (2001) proposed a comprehensive taxonomy which distinguishes five forms of upgrading based on the type of *hierarchies* in which they are embedded, namely industries, factors of production, consumption, value chain stages and forward and backward linkages.²⁵ In later work (2007), he stressed the importance of firm-level upgrading (within the boundaries of the value chain) as the key dimension of upgrading which has to be complemented simultaneously with the industry-level linkages, such as universities and research institutes. His taxonomy embraces the demand side of upgrading (which is mostly ignored) as well as its supply side (which is empirically the most researched), and it emphasises the importance of knowledge transfer within the industry structure for upgrading (more discussion on this in section 2.2.3.2).

²⁴ Ernst *et al.* (1998: 13) define innovation as “the processes by which firms master and implement the design and production of goods and services that are new to them, irrespective of whether or not they are new to their competitors -- domestic or foreign.”

²⁵ These are: (i) *inter-industry upgrading within a hierarchy of industries* (from low to higher value-added industries); (ii) *inter-factoral upgrading within a hierarchy of factors of production* (from natural resources and unskilled labour to specialised skills and social capital); (iii) *upgrading of demand within a hierarchy of consumption* (from necessities to conveniences to luxury goods); (iv) *upgrading according to functional activities within a hierarchy of value chain stages* (from sales and distribution to final assembly and testing, to component manufacturing, engineering, product development, and system integration); and (v) *upgrading within a hierarchy of forward and backward linkages* (from tangible, commodity-type production inputs to intangibles). He criticises the studies that focus only on the first two forms of IU and therefore fail to produce convincing results (Ernst, 2001).

2.2.2 Upgrading within the Global Value Chain (GVC) Framework

2.2.2.1 Global Value Chains

With a sociological approach to economic development, Gereffi (1994, 1995, 1999a) pointed out the changes in global production systems from the hierarchical control of equity relations (as in joint ventures -JVs- or MNCs subsidiaries) towards the types of control exercised in contractual value-chain relationships (e.g. between global buyers, producers and local suppliers within a given industry) in specific industries. He developed the global value chain (GVC) framework to clarify the issue of ‘governance’, by explaining the enforcement of some parameters by lead firms on suppliers operating in low value-added segments of the value chain. Hence he initially (1994) divided industries according to two types of governance – buyer- and producer-driven value chains – in which the leading coordinator of the former is the large retailers, brand-name manufacturers and marketers as well as trading companies mostly in labour-intensive consumer goods industries, acting through decentralised production networks (e.g. apparel, furniture, footwear), whereas that of the latter is the large multinationals particularly in capital- and technology-intensive industries, acting through subcontracting of components (e.g., automotive, electronics).²⁶ Gereffi (1999a) argued that this typology of governance in GVCs shed light on the direct role of global production and distribution networks in the upgrading of domestic industries.²⁷ Although governance allowed value chains to differ from a string of ordinary market relations, the boundaries of this distinction have evolved and blurred over the years, so that he himself has recognised its limitations (Gereffi 2001).

Gereffi’s GVC framework was particularly influential for development economists who have welcomed it as the link between global buyers and developing country producers in industrial clusters.²⁸ Hence, they helped the upgrading literature to position itself

²⁶ See Appendix A for more detailed information on producer- and buyer-driven GVCs and governance issues in GVCs. In fact, producer- and buyer-driven governance structures were well documented in Adam Smith’s *Wealth of Nations* and have been practiced under different names in the world (e.g. *lohn* system in post-socialist countries) (Dyker and von Tunzelmann 2002).

²⁷ In this research, the sector-specific governance of Gereffi in GVCs is one of the reasons for the choice of industries studied (as will be explained in detail in Chapter 4). This research is not interested in the governance issues in GVCs/GPNs *per se*, which is considered as a limitation in the upgrading literature, and will refer to governance in networks only with reference to GPNs/GVCs.

²⁸ In the early 2000s, some researchers, particularly those of the Institute of Development Studies at the University of Sussex (UK), have played a major role in extending the GVC framework to developing country clusters whose location has been driven by their role in global production and distribution systems, mainly as suppliers (Schmitz 1999 and 2004, Humphrey and Schmitz 2000 and 2004a, b). This

within a developing country context and not only attempted to systematically explain the upgrading concept but also made significant contributions to the upgrading literature while benefiting from it in solving a major problem of tools for their cluster analysis, which had suffered from a lack of analytical recognition. They narrowed the focus from IU to ‘local upgrading’ through *extra-cluster* relationships, which is outside the scope of this research (Schmitz 2000, 2003, 2004; Humphrey and Schmitz 2000, 2002, Giuliani *et al.* 2005). Here I will mostly focus on Humphrey and Schmitz’s work (in Schmitz 2004).

Following Gereffi, development economists also attributed significance to governance issues in GVC framework. In an attempt to explain why the lead firms in GVCs prefer to govern their chains rather than relying on coordination through the market, Humphrey and Schmitz (2004a: 96-7) argued that “[g]overnance can be exercised in different ways, and different parts of the same chain can be governed in different ways”. Aiming at exploring the possibility of an association of certain types of value chains with particular types of upgrading, Humphrey and Schmitz (2004b) distinguish four types of control in GVCs, based on the relationship between the buyer/lead firm and the supplier firms. These are:

Arm’s length market relations between buyer and supplier without a close relationship where switching to new buyer or supplier recurs low costs;

Networks where firms cooperate in a more information-intensive relationship with reciprocal dependence and confidence in each other’s specific capabilities;

Quasi-hierarchy where one firm exercises a high degree of control over other firms in the chain, closely monitoring their performance due to doubts about their competence, resembling to ‘captive network/value chain’ (Berger *et al.* 2001, Sturgeon 2002, Gereffi *et al.* 2005) as mentioned in section 2.2.1; and

Hierarchy where the lead firm takes direct ownership of some operations in the chain, as in the case of the MNC and its subsidiaries.

allowed for an extension of geographic interest from Asia (as in the works on GPN literature and in Gereffi’s work) to other developing parts of the world such as Africa and Latin America. Examples include the work of Dolan *et al.* (1999) on Kenyan and Zimbabwean fresh fruit chains in relation to UK food-processing retailers, work on upgrading possibilities for the South African wooden furniture industry (Kaplinsky and Readman 2000, Kaplinsky *et al.* 2003), work on the Tanzanian primary products chain (Gibbon 2001), work on Torreon’s blue jeans industry (Bair and Gereffi 2001), and on Brazilian shoemakers’ upgrading to leather footwear (Schmitz 1995, 1998).

To further GVC framework into a theory of governance, Gereffi *et al.* (2005) have introduced five types of governance in GVCs for analytical use, each derived from empirical observation of the relationship between the lead firm and its suppliers. These are:

Markets where linkages can persist over time, with repeat transactions but do not have to be completely transitory with low costs of switching to new partners for both parties;

Modular value chains where suppliers make products to a customer's specifications with or without detailed specifications (the latter requires being a 'turn-key services' supplier);

Relational value chains where interactions between buyers and sellers are complex with mutual dependence and high levels of asset specificity and managed through trust and reputation with or without spatial proximity;

Captive value chains where small suppliers are transactionally dependent on much larger buyers with high switching costs, a high degree of monitoring and control by lead firms;

Hierarchy which is characterised by vertical integration with the dominant form of governance being managerial control, flowing from managers to subordinates, or from headquarters to subsidiaries and affiliates (Gereffi *et al.* 2005:83-84).

Their typology is a mixture of GVC and GPN perspectives to the governance. Humphrey and Schmitz (2004b) uses the term 'networks' in the sense of the modular production networks of Sturgeon (2002), but without making a specific distinction between the types. Both typologies not only categorise networks as a hybrid lying between markets and hierarchies but also define networks as mechanisms where power relations are exercised in some way or the other. Moreover, they stem only from production systems.

2.2.2.2 Key Features of Upgrading in GVC Framework

Gereffi (1999a:51-2), who introduced the upgrading notion into the GVC framework, defines IU as "a process of improving the ability of a firm or an economy to move to more profitable and/or technologically sophisticated capital and skill-intensive economic niches". In this definition, IU becomes a process of gradual shift from lower to higher value-added activities within the value chain. It focuses on the upgrading possibilities of *products* (from products which are cheap and simple to ones which are complex and expensive), *production processes* (from mass production of standardised products to flexible production of differentiated products), *positions in the value chain*

(from simple assembly to more integrated forms of production -such as OEM or OBM, involving greater use of forward and backward linkages), and *chain developments*. Moreover, Gereffi (1999a) proposes to examine IU with a more explicit focus on the geographic dimension, e.g. within factories, within inter-firm networks, within local or national economies, and within supranational macroregions. His typology emerges from trends and changes in international trade in a given industry, namely the evolution of the apparel industry (Gereffi 1999b, Ramaswamy and Gereffi 2000, Bair and Gereffi 2001, Gereffi and Memedovic 2003).

Drawing upon Gereffi's definition, Humphrey and Schmitz (2004b) distinguish four types of upgrading with the purpose of operationalising the concept. Their focus is explicitly on the improvements in firm's activities rather than on measuring upgrading e.g., by means of firm performance measures. They are:

- (i) "***process upgrading*** (transforming inputs into outputs more efficiently by reorganizing the production process or introducing superior technology);
- (ii) "***product upgrading*** (moving into more sophisticated product lines, which can be defined in terms of increased unit values);
- (iii) "***functional upgrading*** (acquiring new functions in the chain or abandoning existing functions to increase the overall skill content of activities; as frequently discussed in the literature, following a route of transition from assembly to OEM to ODM (original design manufacturing) to OBM); and
- (iv) "***inter-sectoral upgrading*** (using the knowledge acquired in particular chain functions to move into different sectors)" (Humphrey and Schmitz, 2004b: 352).

The empirical case studies that led to the development of this typology (e.g., Schmitz 1995, 1998, 2003, Dolan *et al.* 1999, Hsing 1999, Kaplinsky and Readman 2000, Bair and Gereffi 2001, Gibbon 2001, Kaplinsky *et al.* 2003, Bazan and Navas-Aleman 2004, Kishimoto 2004) have also created a pool allowing for generalisations that improve the upgrading literature (Schmitz 2006). There is more recent work that attempts generalisations through some statistical applications (McDermott and Corredoira 2010, Özatağan 2010, Navas-Aleman 2011).

Moreover, some recent approaches have tended to move away from the hierarchical orientation found in the foregoing. These approaches tend more towards comparison of the firm's upgrading with respect to their competitors (Kaplinsky and Readman 2001,

Meyer-Stamer 2004) as well as defining upgrading in terms of the innovation capacity of the firm (Kaplinsky and Readman 2001, Giuliani *et al.* 2005, Ernst 2011). Drawing on Kaplinsky's emphasis on rents and Porter's operational effectiveness (i.e. performing similar activities better than rivals perform them), Meyer-Stamer (2004) criticises the perception of upgrading only as 'moving up'.²⁹ He defines upgrading as "doing things differently, and/or doing different things – not different compared to previous practices in the same company, but compared to competitors" (Meyer-Stamer 2004: 332). Recent empirical research supports Meyer-Stamer's definition of upgrading based on the evidence for the co-existence of types of upgrading (Ponte and Ewert 2009) as well as on the evidence that firms serve multiple value chains and present better upgrading prospects than the ones that are locked into one type of value chain (e.g. captive) (Navas-Aleman 2011). Criticisms of *upgrading* have been reflected in a move to a less linear, hierarchical approach in which upgrading refers to 'reaching a better deal' for developing country firms within GVCs in the development context (Ponte and Ewert 2009).

Kaplinsky and Readman (2001) further assess the role of competitors in firm-level upgrading by stressing how fast the firms *innovate* compared to their competitors as part of the upgrading process. Giuliani *et al.* (2005) stress the importance of both firm-specific efforts and actions and environmental features that characterise learning and innovation patterns in specific sectors. They both consider 'capacity to innovate' to be the key capability for upgrading; this in turn requires an ability to learn within the broader systems of innovation (see also Pietrobelli and Rabellotti 2011).

2.2.3 Differences between GVC and GPN frameworks

This section discusses the differences between the GVC and GPN frameworks with regard to the use of 'network' and 'learning' concepts within the upgrading literature. These differences are explicated chiefly in terms of the limitations of the GVC framework in comparison with the GPN framework. The first limitation with regard to

²⁹ In his words, "upgrading is not a priori about a direction, such as upwards" (Meyer-Stamer 2004: 332). He also argues (*idem.*) that "upgrading is much more contradictory and confusing than the Humphrey/Schmitz-typology would suggest – the direction is a priori unclear, and therefore it is difficult, for instance, to assess the necessities in terms of factor conditions resulting from companies' upgrading efforts." He provides examples of voluntary downgrading in the empirical studies on Brazilian clusters and discusses the cases of firms which experience upgrading and downgrading in different functions at the same time (see also Rabellotti 2004).

‘networks’ is related to the attention devoted to governance in GVCs: The way networks are categorised within the modes of governance in the GVC framework. The second is a limitation of the value chain itself that is reflected in the analysis of networks in GVC framework: The way networks are analysed as linear structures as part of, or derived from, GVCs.

The limitation with regard to ‘learning’ is related to the way learning in GVCs is narrowed down to learning-by-exporting and learning-by-doing, which are assumed to be learning processes that occur automatically as a result of being integrated into GVCs. Upgrading via GPNs has originally been founded on considerable opportunities for (international) knowledge transfer and substantial learning effects that allow gradual upgrading at the firm level that comprehends knowledge-based linkages at the industry level (Ernst 2000a, 2001, 2008, 2009) and other actors (Coe *et al.* 2008b). Although this was done with the abovementioned narrow focus in GVCs for a long time, scholars working within the GVC framework lately show a tendency to revise the importance attributed only to learning-by-exporting and by-doing (Schmitz 2006).

2.2.3.1 Networks in GVCs

a. As mode of governance

In the context of emerging markets, the use of the GVC framework in upgrading research has led to valuable insights into the governance issues in the value chain as the main determinant in the upgrading of suppliers in the chain and come to dominate the upgrading literature. This is because this literature draws heavily on economic theories of governance that emphasise the boundaries of the firm and the decision to ‘make or buy’ (Williamson, 1981) (see also Appendix B.1).³⁰ The governance typologies of Humphrey and Schmitz (2004b) and Gereffi *et al.* (2005) (section 2.2.2) make use of Williamson’s conceptualisation of the governance structure of the firm based on

³⁰ To make the argument that it is the insufficiency of market operations in monitoring transactions that leads to the emergence of firms (hierarchies) as a mode of governance, Williamson (1981) created a dichotomy of markets versus hierarchies, in which the decision ‘to make’ stands for the complete vertical integration of production within the firm, coordinated by internal corporate hierarchies, and the decision ‘to buy’ stands for market exchange mechanisms such as contractual or out-sourcing relationships. His work defines the existence of the firm by using the ‘transaction’ as the unit of analysis and emphasises the interaction of ‘bounded rationality’, which relaxes the ‘perfect information’ assumption of neoclassical economics, and ‘opportunism’ (self-interest seeking with guile) as behavioural assumptions to explain the reasons for the difficulties and the costs of market transactions, i.e. contracts between firms.

transaction costs economics, which locates networks as an intermediate or hybrid form in between markets and hierarchies (as in Thorelli 1986, Contractor and Lorange 1988, 2002; see also Bair 2008) explaining the coordination of interdependent activities that take place within the value chain in terms of the transaction-cost approach that “addresses the firm primarily in terms of its governance and exchange attributes rather than its productive attributes” (Madhok, 2000: 277). By doing so, upgrading researchers following GVC framework view markets and hierarchies as located at the opposite ends of a continuum and naturally locate networks in between them. However, researchers who use the GPN framework view production networks as “a *sui generis* form of economic organization” (Ernst 1997: 31; Coe *et al.* 2008b: 272) that makes it possible to “develop more cooperative, two-way forms of cooperation between the parent company, its affiliates, and network partners” (Ernst 1997: 35). While GPN scholars do recognise the asymmetry between the buyers and suppliers that is reflected in the power relations under which a lead firm controls and coordinates the activities in the GPNs (section 2.2.1)³¹ their approach covers a wider scope of relationships within GPNs by including all relevant sets of actors and relationships (Coe *et al.* 2008b) – not only intra-firm and inter-firm transactions, but also research organisations within industry-level linkages (Ernst 2001).

Upgrading researchers following GVC approach define networks as relationships characterised by reciprocity and mutual dependence of parties involved and by the modularity in production (cf. Sturgeon 2002). They argue that developing country firms have started experiencing modular networks in addition to quasi-hierarchical relations, but have still not developed, or been able to insert themselves in to, the innovation networks of the developed country firms (Humphrey and Schmitz 2004a, Gereffi *et al.* 2005). This observation drew attention to the fact that reliance on the chain approach is not enough to explain the determinants of such differentiated changes in the evolution of networks (Humphrey and Schmitz 2004b).

b. As a linear structure

Value chain “captures a process of sequential transformation from inputs, through stages of transformation to outputs and through to distribution and final consumption, a

³¹ Economic geographers try to overcome this limitation by changing the analytical focus from the lead firm to a different position in the networks, and yet end up recognising that the dominant player in a GPN is the ‘lead’ firm, by definition (Coe *et al.* 2008: 277).

sequence in which each stage adds value to the process of production of goods or services. It is the set of processes that is conventionally involved in supply chain analysis.” (Coe *et al.* 2008b: 274).

“A chain maps the vertical sequence of events leading to the delivery, consumption and maintenance of goods and services” (Sturgeon 2001:10).

Such a chain structure represents a *vertical relationship* between buyer/customer and supplier, unless it refers to the ordinary ‘supply chains’ that represent product-based flows for processing raw materials into finished products and are linear but to ‘value networks’ (high-end supply chains) that are inherently about chains of functions and are non-linear and complex in structure (von Tunzelmann 2010b). As long as the issue of ‘governance’ in value chains dominates the analysis in the GVC framework and the concept of ‘networks’ is classified as a governance type within the value chains, the treatment of networks in that framework will be constrained by the excessively vertical structure of the value chain concept. The influence of transaction cost economics and strict adherence to a GVC framework lead researchers to ignore any relationships other than chain-centred relationships; however, to discuss networks in the context of vertical relationships alone is to miss parts of the picture.

Sturgeon (2001) and economic geographers (Coe *et al.* 2008b) also put emphasis on clarifying the distinction between value chains and production networks.

“A network highlights the nature and extent of the inter-firm relationships that bind sets of firms into larger economic groups” (Sturgeon 2001: 10).

Coe *et al.* (2008b) distinguish GPNs from the linearity of GVCs by highlighting the inclusion in GPNs of all kinds of network configurations, including non-linear/horizontal relationships, occurring throughout the process of sequential transformation from inputs to outputs, as well as knowledge diffusion /sharing through technology cooperation networks (Ernst 1997, 1998, 2001; see section 2.2.1). Such horizontal relationships are outside the scope of the GVC framework, as they are viewed as ‘innovation networks’ that result from producer-user interaction only in developed countries and in which the developing country firms do not have the capabilities necessary for participation (Humphrey and Schmitz 2004b).³² Focusing only on the buyer-supplier relationships means that we miss the complementary competencies that

³² See Ernst (2008, 2009) for counterexamples.

are not located in segments of the value chain³³ and overlook the fact that the actors in (different types of) networks are varied and naturally outnumber the actors in the value chain. Finally, the almost exclusive emphasis on the linear value chain (rather than other functions of a firm such as marketing, finance and technology) and its static flavour (efficient governance in a given chain) does not facilitate examination of the *dynamics* of upgrading.

2.2.3.2 *Learning*

Learning is a crucial part of the upgrading process. While Ernst (2001) integrated evolutionary aspects of learning into the GPN framework and enriched our understanding of knowledge spillovers, sharing and diffusion in GPNs, the approach of GVC researchers to learning has always been analytically narrow.

a. Learning in Global Value Chains

The participation of the firm in GVCs is imposed as “a necessary step for industrial upgrading” as it is assumed that this participation “puts firms on potentially dynamic learning curves” (Gereffi 1999a:39), making the whole learning process a natural outcome for all value chains – i.e. *learning-by-exporting* (Schmitz and Knorrinda 2000). This engagement in GVCs provides suppliers the opportunities for *learning-by-doing*, and by gradually upgrading their capabilities, suppliers are able to improve their position in the GVCs by increasing their competitiveness throughout the upgrading process and eventually to become buyers themselves (Gereffi and Tam 1998, Gereffi 1999a). In this literature, the IU concept is based on learning through both forward (marketing) and backward (sourcing) linkages in the value chain and the kind of learning that occurs across these segments and creates new resources and capabilities (Gereffi 1999a,b).³⁴

³³ An example would be the case of a joint venture in which a transition country firm provides knowledge on how to navigate its domestic markets to its foreign partner, while the latter provides knowledge on new technology (see e.g. Yoruk 2002b).

³⁴ The logic presented here is explained by Bell (1984:188-9): “The execution of production tasks in one period generates a flow of information and understanding which allows execution to be improved in a subsequent period. This flow of ‘learning’ is therefore seen as a feedback process which operates within production activity. It also seems to involve two distinguishable components. One is a flow of information which stimulates search for improvement, this is usually information about system performance; it consists of information about problems encountered or opportunities perceived. The second is a flow of understanding and knowledge about *how* change might be made. The execution of production activities generates a flow of knowledge about how the particular system ‘works’. The increments of knowledge enable better methods to be defined, in trying out such methods, further flow of

Nevertheless, learning in GVCs is not a straightforward process where the knowledgeable partner readily provides it to the supplier in the chain. On the contrary, whether the knowledge will be transferred explicitly or implicitly along the chain activities is a decision of the lead firms (thus depending on the hierarchy of actors). The empirical studies to date identify two consequences for learning of these power relations exercised in GVCs. First, the upgraded supplier becomes more expensive, particularly in LMT industries where margins lie in cheap labour costs. Therefore, it is not in the interest of the lead firms to transfer knowledge to their suppliers in GVCs more than required for the provision of effective, high-quality production (Gibbon 2000, Schmitz 2006). Knowledge transfer is clearly restricted to the sphere of production activities - hence the discussion of learning within the context of learning-by-doing. When the core competences of the lead firms lie in non-production activities, such as branding, marketing, etc., they are not shared with their suppliers either (Palpacuer 2000). On the contrary, the suppliers are discouraged to improve their capabilities in these functions so as to keep their unit labour costs low; otherwise, the lead firm will move production to other (cheaper) countries (as also highlighted by Baldwin (2011, 2012) in his analysis of global supply chain economics above).

Second, suppliers with low capabilities receive more training from the lead firms (mostly with manufacturing expertise) than suppliers with higher capabilities. The rationale is to help the suppliers with low capabilities to function at a required level of quality, while preventing the further upgrading of a supplier with higher capabilities, which could create a potential rival. Suppliers with high capabilities are preferred only when the level of quality pursued is appropriate and the suppliers do not need to be trained by the lead firm in GVCs. Thus, learning abilities in GVCs very much hinge upon the capabilities of the supplier firms and to milk knowledge from the lead firms, e.g. in the form of knowledge spillovers. Yet, empirical case studies also show that as the capabilities of the suppliers increase over time, the support of the lead firms in GVCs diminishes (Humphrey and Schmitz 2004a, 2004b, Tokatli and Kizilgün 2004, Schmitz 2006). Acknowledging that firms still face many obstacles to moving up in

these chains and particularly in achieving functional upgrading, empirical studies try to understand why (Schmitz 2004, 2006, Navas-Aleman 2011).

Recent studies on upgrading have started to make references to learning in different contexts. Sturgeon and Gereffi (2009) talk about ‘upgrading as learning’ by linking measurement of upgrading to learning by means of Lall’s (2000) technological classification of goods exports. Schmitz and Strambach (2009) try to gain insights from innovation systems and GVC perspective to understand the ‘organisational decomposition of the innovation process’.

b. Learning in Global Production Networks

Most of the early (regional and sectoral) studies on GPNs in the 1990s were developed within the literature on economic and industrial integration (in articles published by the Berkeley Roundtable on International Economics). For instance, Zysman *et al.* (1997) discuss the importance of cross-national production networks in integrating CEECs into the wider Europe. Their initiative was supported by the contributions of other authors, more descriptively than empirically (van Tulder and Ruigrok 1998, Kurz and Wittke 1998, Linden 1998, Eichengreen and Kohl 1998, Henriot and Inotai 1998, Guerrieri 1998, Graziani 1998, Comisso 1998). Hence, these early studies all mentioned the importance of learning that takes place within GPNs for the less developed partner, but failed to detail how.

Ernst is one of the first researchers in the upgrading literature who dealt with the role of GPNs as carriers of knowledge flows and diffusion (Ernst 2000a and 2001, Ernst and Kim 2002).³⁵ Then he made a significant contribution by systematically linking knowledge transfer and learning through GPNs with the concept of IU, which became a new source of growth for developing country firms (Ernst 2000b, 2001, Ernst *et al.* 1998). He distinguished three indirect forms of knowledge diffusion within subcontracting relations of GPNs:

“*Learning facilitation* which results from the exposure of the local subcontractor to the foreign buyer's qualification process, including testing and diagnostic feedback on

³⁵ In his early works, he investigated GPNs with respect to global competition and geographical dispersion by using firm case studies (Ernst 1997, 2000b), making specific studies of industries (e.g. electronics - Ernst 1997, 1997b and 2001, computers - Ernst 2000a, textiles - Ernst *et al.* 1998, and information technology - Ernst 2000b) and comparing countries (e.g. Korea versus Taiwan in Ernst 1994, 1998, 2000b and 2001, later Japan and China with the US).

quality and other dimensions of the performance of the supplier's products, the sourcing of technical experts to solve specific technical problems encountered by the supplier, and advanced indications on future quality/performance /feature requirements and targets; *knowledge spillover effects* which include product design specification and performance requirements, early supplier involvement in prototype development, access to technical and marketing information on competitors' products, informal sharing of technical information and ideas among the technical staff of both companies, and exposure to the foreign company's system of managing production and R&D, and *investment inducement* which relates to investments in the formation of technological capabilities which the local supplier can only undertake because the subcontracting relationship reduces the perceived risk of such investments through a procurement commitment by the foreign company. This is true because the foreign company provides a stable source of income to finance the investment, in addition to access to superior market information that may reduce the risks involved in the investment decision" (Ernst 1997: 72).

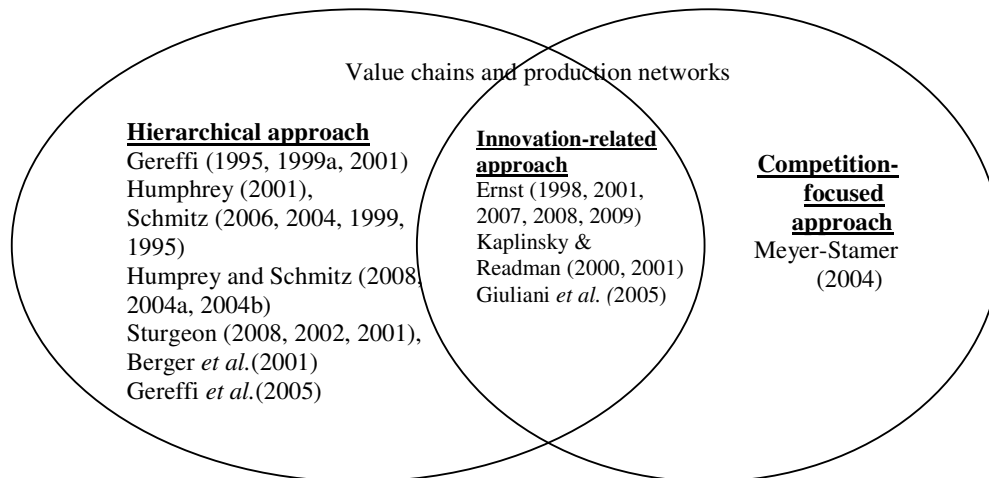
Following the evolutionary tradition (Nelson and Winter 1982), he argues that IU necessitates an evolution of technological learning, which is possible through the strengthening of the capabilities of the firm, but is not sufficient alone (Ernst 1997). He stresses the role of firms in IU and the external determinants of the firm behaviour as well as the internal. He suggests that the co-evolution between firm behaviour and industry structure should be taken into account, if IU is a result of the firm's achievement of certain features that are necessary for its long-term growth (section 2.2.1); these features are access to markets, access to capital, managerial skills, technological skills and innovative activities.

2.2.4 Similarities of GVC and GPN Frameworks

The upgrading literature emerged as a response to the globalisation that dramatically changed the organisation of industrial production. Therefore, the upgrading concept has initially been explored within the framework of *global* value chains and production networks. There are important complementarities between GPNs and GVCs (Ernst 2001). Defining IU in more or less the same way, both frameworks link the global buyers / producers and developing country producers / suppliers within the production systems with upgrading outcomes for the latter. Within both frameworks, analysis is conducted initially within the boundaries of value chains, stressing the governance issues in these production linkages. The three streams of literature that develop and use GVCs / GPNs have interconnected origins and feed each other's development: Value chains are considered as one of the antecedents of GPNs (Hess and Yeung 2006).

The major similarity of the two frameworks lies in two approaches to upgrading that can be found in both literatures. One is the ‘hierarchical approach’ of Gereffi, Ernst (in his early work) and Humphrey and Schmitz, based on ‘moving up’ the value chains, mostly in buyer-driven governance structures. The other is the ‘competition-focused’ approach of Kaplinsky and Readman and Meyer-Stamer, which defines IU in terms of a comparison with the capabilities of competitors. Upgrading is a kind of ‘moving forward’ by doing things ‘faster’ (Kaplinsky and Readman) or ‘differently’ (Meyer-Stamer) than rivals, but still based on value chains. So both approaches are limited by the linearity of value/production chains. A third approach, the innovation-related approach, is sort of offspring of the first two. This third approach is exemplified by Kaplinsky and Readman, the later work of Ernst, and Giuliani *et al.* (Figure 2.1). Ernst discusses the importance of knowledge transfer that makes upgrading a function of innovation, and Kaplinsky and Readman and Giuliani *et al.* discuss the capacity to innovate as key source of upgrading.

Figure 2.1 Summary of theoretical approaches to upgrading



Source: Author

As a result, this research builds on the complementarities between these approaches to upgrading and refers to them as GVCs/GPNs, while keeping in mind the differences between them. The next section will present the theoretical framework of this research, which brings them together while filling their gaps with an evolutionary approach to networks and learning.

2.3 THEORETICAL FRAMEWORK: IMPROVING THE UPGRADING LITERATURE BY FILLING THE GAPS

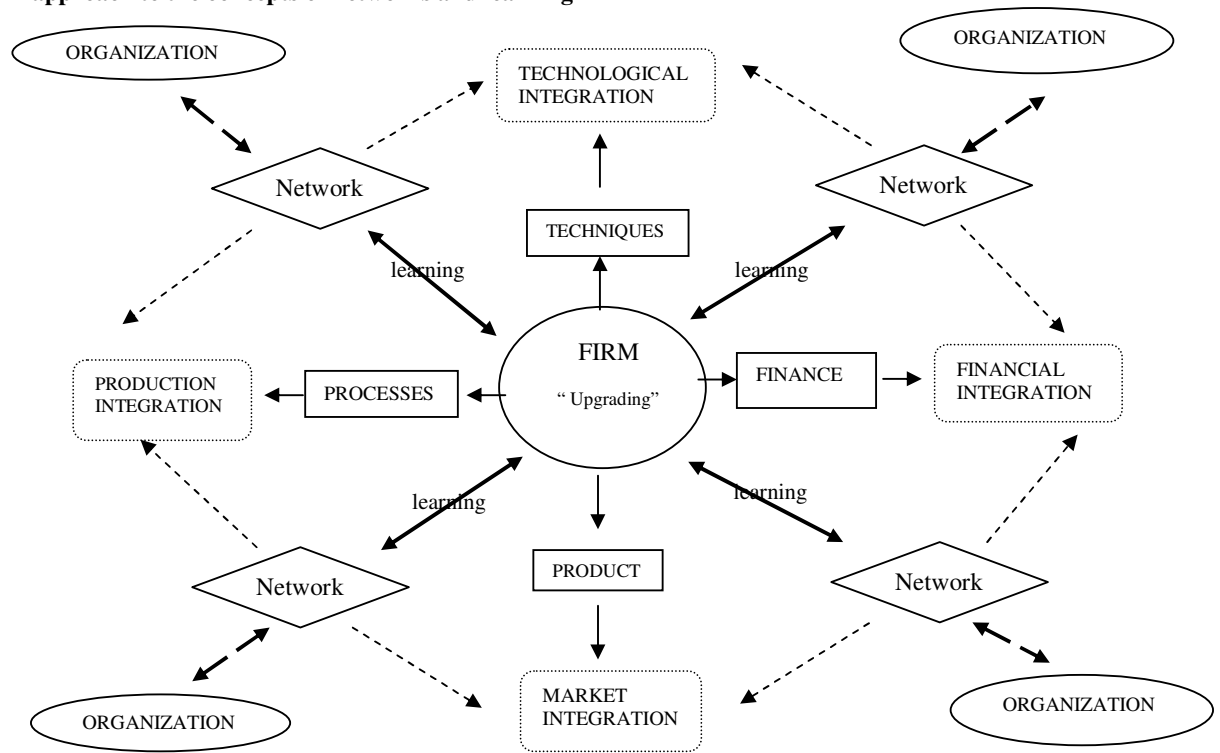
As discussed above, different research streams examine firm and industry-level upgrading - a concept that has emerged from the globalisation and deverticalisation of production and the requirements for integration between regions and countries, using frameworks based on 'external' linkages of the firm, such as value chains and production networks. However, they differ in their approach to governance issues and the level of structural complexity in these external linkages and to the learning opportunities in these linkages. For the purposes of this research, the comprehensive approach of GPN framework to knowledge transfer and learning provides more guidance to investigate firm-level upgrading than the GVC approach (particularly the work of Ernst), although the GVC framework contributes with the operationalisation of firm-level upgrading by taking firm functions as a guide (particularly the typology of Humphrey and Schmitz 2004). Yet, there is still a need for further improvements.

Drawing on theoretical insights from both approaches, this section proposes a theoretical framework that aims at filling the gaps in the upgrading literature by distinguishing networks that are embedded in knowledge systems from those embedded in production systems, and by clarifying the respective roles of inter- and intra-organisational learning. Hence, it aims to improve the scope of the concepts of 'networks' and 'learning' to bring them as close to reality as possible.

Adapting from von Tunzelmann's (1995) micro-level taxonomy for production in the firm to the networking relations of the firm in these functions, the theoretical framework of this research has three key features. First, as depicted in Figure 2.2, having 'the firm' at the core of the analysis, it builds the upgrading concept around the functions of the firm. Second, it comprises a wide range of networks not only with other firms but also with other institutions that are present in the economic environment and are related to the industry, grouping all of these under the heading 'organisations'. Third, learning is ideally an interactive 'process' between networks and upgrading (as shown with the two-way arrow) that contributes to the 'outcome' of firm-level upgrading in one of the firm functions, rather than an automatic outcome of networking.

This framework asserts that the learning occurring through networks with a variety of organisations underlies the upgrading in specific firm functions that leads to associated integration (dotted boxes) of firms, industries and countries. The dotted rectangles illustrate the macro-level understanding of the origins of upgrading as discussed in the literature; however, no form of integration is dealt within this research. This research will focus on the *micro-level* analysis of upgrading and investigate how firms upgrade through involving in networks by making use of an evolutionary aspect of learning as a tool of analysis.

Figure 2.2 Theoretical Framework for the analysis of firm-level upgrading in the light of a wider approach to the concepts of networks and learning



Source: Adapted from Von Tunzelmann (1995: 391).

Therefore, the boundaries of these concepts need to be revisited to overcome the limitations imposed by the frameworks used to examine firm-level upgrading so far. First the systems in which networks originate are examined and then network theories of the firm (that view networks as source of knowledge and learning) are reviewed. Next, the evolutionary literature on learning is reviewed, beginning with empirical contributions in the context of developing country firms, and then theoretical

contributions with regard to the ways learning takes place externally and internally to the firm.

2.3.1 Networks

The term ‘chains’ refers to broad patterns at the ‘meso’ level of industrial organisation, while the term ‘networks’ refers to micro-level inter-firm relations with actors and interactions. Due to its linearity, the chain approach to upgrading is not able to capture the impact of other types of factor inputs from different types of sources (such as unskilled / skilled / managerial labour, physical/ working/ intangible capital in the form of ‘technology’) (Dyker and von Tunzelmann, 2002; Coe *et al.* 2008b). The upgrading research to date sheds light both on the bottlenecks of the chain approach and on the necessity of moving from chain to network analysis in order to significantly improve our understanding of the upgrading phenomenon.

This research also argues that in order to understand the *dynamics* of upgrading in relation to the evolution of firms and industries, it is equally important to assess knowledge transfer and learning in relationships that are embedded in knowledge systems. Knowledge networks enrich the analysis of firm-level upgrading by adding cross-cutting horizontal issues (such as links with technology suppliers and developers, links with university/ research labs and consulting firms) to value chains and production networks. In traditional industries in emerging markets, which are generally undermined as low-technology (see section 1.2.2), these issues are at the core of IU discussions.

2.3.1.1 Systemic Origins of Networks

In order to theorise IU within the GVC/GPN frameworks, the upgrading concept is linked strongly and only to GPNs and GVCs and to knowledge and information flow within their contexts as the basis for firm-level upgrading.³⁶ However, they are largely isolated from technological developments and knowledge transfer processes sourced from outside the GVCs / GPNs. But in addition to the globalisation of trade, a process of evolution toward knowledge-based economies also plays an important role in the development of many middle-income countries and emerging markets. When we take this into account, it becomes problematic to limit our treatment of the interactions that

³⁶According to Humphrey and Schmitz (2004b: 349), “The upgrading opportunities of local enterprises are often structured by the relationships in global value chains”.

take place in an industry to those occurring within value chains. For instance, food-processing firms have interaction with horizontally-related firms in high-tech areas (section 1.2). Upgrading in such industries is very much linked to networking relations of the firms for purposes other than simple production activities, and this introduces a complex dimension into the discussion that goes far beyond the value chain. Hence, it is important to recognise that while the functional elements (such as marketing, design, etc. and especially technology) emphasised in many case studies on upgrading are parts of the value chain, the relationships developed with other organisations to pursue cooperation in these functional areas are often horizontal and outside the value chain. It is, therefore, unsatisfactory both to limit the upgrading concept to value chain activities and to combine simple R&D or innovation efforts with a value chain concept that is embedded in production systems.

Development economists, however, prefer to exclude these actors and complexities as ‘external forces’. Economic geographers see this as a weakness and include ‘non-firm’ actors in the GPN framework (Coe *et al.* 2008b). Ernst (1997) talks about complex, multitier networks of networks of marketing, production and innovation and emphasises the importance of industry-level linkages (with universities and research institutes) for successful firm-level upgrading (Ernst 2007); while in his network alignment paradigm, von Tunzelmann (2010a) suggests networks where the relationships are many-to-many rather than one-to-the-next.

However, networks do not come to life in isolation from other factors. It is often overlooked that networks arise in connection with ‘systems’.

“Much of the literature is written as if the organisation in focus has one particular system to integrate, whereas in actuality it finds itself spread across many ‘systems’ of different types, some more ‘systemic’ in the way they function than others” (von Tunzelmann, 2010a: 3).

Drawing on this view, this research expands its focus to knowledge systems with the aim of analysing the role, in firm-level upgrading, of knowledge that is acquired from organisations outside the production systems in addition to those inside the production systems. Knowledge systems have contributed importantly to our understanding of the technological dynamics of developed countries, but there is only limited empirical research about how knowledge networks emerge and evolve in the specific context of

large firms in developing countries in general and none in transition economies in particular (Bell and Albu 1999, Dyker 2004d).

Building on the treatment of technological change in six studies that use the GVC framework as equal to machine-centred forms of change, Bell and Albu (1999) contributed by conceptually distinguishing ‘knowledge systems’ from ‘production systems’ in order to shed light on the processes of acquisition and accumulation of change-generating capabilities through both materials-centred (i.e. production and trade) and knowledge-centred processes (i.e. technological change):

“The production system can be understood to encompass the product designs, materials, machines, labor inputs, and transaction linkages involved in production of goods to a given specification [while] the knowledge system concept on the other hand, encompasses those flows of knowledge, stocks of knowledge and organizational systems involved in generating and managing changes in the products, processes or organization of production. ... Materials specifications and purchasing systems, detailed product designs and blue-prints, particular labor skills and operating routines, specific quality assurance standards, distribution arrangements etc. all form elements of a production system. The existence and nature of trading linkages and contractual arrangements with suppliers, buyers, subcontractors are also included in the concept, as might be details of the physical, social and legal infrastructure which supports the industry in its current state” (Bell and Albu 1999: 1723).

Knowledge systems have roots in ‘technology systems’ in evolutionary economics (Carlsson and Stankiewicz 1991, Carlsson 1994, 1995) and comprises knowledge stocks within firms and knowledge flows to firms from outside the system, between firms and other institutions within the system “which underlie change in types of goods they produce and the methods they use to produce them” (Bell and Albu, 1999: 1722). Such change may contribute and generate upgrading. The authors also emphasise the overlap between both systems, and yet, urge that they are not identical as

“[a]ctors in one may not be actors in the other. Similarly, knowledge flows may be carried along the same channels as those concerned with market transactions over goods - as for instance in the common case of flows of new technology into clusters from external buyers of their products” (Bell and Albu 1999: 1723).

As stated above, the upgrading literature is deeply framed by production systems, which is a broad concept that does not tell us much about the evolution of the firm: GVCs are embedded in production systems and rely on the knowledge flows within this system as described by Bell and Albu (1999) above, and yet did not take into account relationships that stem from knowledge systems. While upgrading researchers who follow the GPN framework emphasise the importance of non-firm actors (Coe *et al.* 2006) and industry-level linkages (Ernst 2007) for IU in addition to firm-level

upgrading (section 2.2.3.1.2), GPNs, like GVCs, are also extensively rooted in production systems, and this gives rise to concerns about its comprehensiveness. So, it is necessary to complement GVC / GPN frameworks with networks embedded within knowledge systems.

2.3.1.2 Networks as source of knowledge and learning

As discussed in section 2.2.3 above, by viewing markets and hierarchies as located at the opposite ends of a continuum and locating networks in between them, upgrading researchers following the GVC framework overlook the existence of varieties of governance structures in market economies (e.g. complementary or competitive) that in fact explain the presence of networks (see Johanson and Mattson 1987). The variation in approaches to networks in the literature arises from the different academic disciplines of the researchers and creates a wider perspective on networks as modes of organisation, cooperation and growth. The insights contained in this literature strongly suggest that networks should be treated as a separate phenomena in their own right rather than as an intermediate form of governance between markets and hierarchies (Powell 1990, Chesnais 1996, Hamilton and Feenstra 1998). In fact, Hess and Yeung (2006) regard the approaches of economic sociologists to networks and embeddedness in networks as another antecedent of GPNs.

Although scholars use different terms to refer to networks, and it is difficult or impossible to identify clear-cut types or definitions of networks, the real-life structures studied have common features that justify treating them under one heading (see, e.g. Granovetter 1985, Håkansson 1987, Powell 1990, Zukin and Di Maggio 1990, Thompson *et al.* 1991, Grabher 1993, Möller and Wilson 1995, Gulati 1998 and 1999, Kogut 2000; Table 2.1 and Appendix B explain the various approaches to networks). Networks with varied forms of cooperation have become important in business, strategy and innovation, with growing incidence and differing motives (see Cimoli and Constantino 2000; Powell and Grodal 2005). Starting in the 1980s, changes in networking were tracked by academic researchers in terms of both quantitative indicators and qualitative changes (for a survey of networks, see Freeman 1991). In the 1990s, the focus of network studies shifted from on network formation (Gulati 1998, 1999) - including the creation of networks, their forms and the motives for establishing them - to dynamic processes within networks, such as knowledge transfer (Mowery *et*

al. 1996, Simonin 1999 and 2004) and knowledge sharing and learning (Powell *et al.* 1996, Håkansson *et al.* 1999), and their impacts on the evolution of networks (Hite and Hesterly 2001, Saxenian 2002). This change was a response to the demands of the knowledge-based economy, as firms have begun to search for new external knowledge through means differing from those they have employed inside the firm, particularly for the continuity of technological development. Most of this work has studied the networks of developed country firms in high-tech industries.

Table 2.1 A summary of network types and key publications in the network theories of the firm

School	Type of network	KEY PUBLICATIONS
Sociology	Social networks	Granovetter (1985); Zukin and DiMaggio (1990); Powell (1990); Walker (1988), Uzzi (1997)
Industrial organisation	Industrial networks	Thorelli (1986); Uppsala School - Hägg and Johanson (1983), Johanson and Mattson (1987), Håkansson and Johansson (1988), Håkansson (1987, 1989, 1990);
	(Global) production networks	Zysman <i>et al.</i> (1997); Zysman and Schwartz (1998); Borrus and Zysman (1997); Borrus (1997); Berger <i>et al.</i> (2001); van Tulder and Ruigrok (1998); Kurz and Wittke (1998); Sturgeon (2002); Ernst (1998, 2000a, 2001); Pickles <i>et al.</i> (2006); Smith <i>et al.</i> (2008)
Strategy	Strategic networks	Jarillo (1988, 1990); Gulati (1998, 1999); Gulati <i>et al.</i> (2000), Ahuja 2000, Chung <i>et al.</i> 2000
	(International) Strategic alliances	Contractor and Lorange (1988); Lorange and Roos (1993); Lu and Burton (1998); Wilson and Moeller (1995); Spekman and Celly (1995), Inkpen (1998)
	Strategic technology alliances	Hagedoorn (1992, 1993); Mytelka (1991, 2001); Michaellet (1991); Narula (1996); Narula and Sadowski (2002)
Evolutionary economics	Techno-economic networks	Chesnais (1992, 1996); Coombs <i>et al.</i> (1996)
	Innovation networks; Knowledge networks; Learning networks	Nelson (1991); Carlsson (1995); Edquist (1997); Lundvall (1988, 1992c); Archibugi and Lundvall (2001); Rothwell and Gardiner (1983); Nelson and Rosenberg (1993); Mowery (1998); von Hippel (1988); Hagedoorn, Link and Vonortas (2000); Coombs and Metcalfe (2000); Belussi and Arcangeli (1998); Gelsing (1989, 1992); Bessant and Francis (1999); Bessant, Kaplinsky and Morris (2003); Bell and Albu (1999); Giuliani and Bell (2005); Dantas and Bell (2009).

Source: Compilation by the author

However, one of the major premises of network theories of the firm has been the vital role of networks in bringing the inequality between firms' knowledge stocks into balance by serving as a source of external knowledge for firms that do not have it, and as a means for learning opportunities (Johanson and Mattson 1987, Contractor and Lorange 1988, Levitt and March 1988, Hamel *et al.* 1989, Powell 1990, Hamel 1991, Gulati 1995, Uzzi 1997, Inkpen 1998, Kogut 2000). The main contribution of networks to firms is allowing them to have access, through formal and informal interactions, to

the ideas, resources, and knowledge of other firms whose activities may be of a complementary or competitive nature. This can take the form of user advice (collaboration with users), technical expertise (technology acquisition), scientific research results (collaboration with universities, government laboratories, research institutes), marketing activities (cooperation with consultants), and so on (Freeman 1991). In this way, networks become a ‘mode of cooperation’ rather than a ‘mode of governance’ that is based on a decision of not ‘to make’ but ‘to cooperate’ with others that have the capability to perform those functions (Kogut *et al.* 1992).³⁷

2.3.1.3 Knowledge networks

The abovementioned type of relationships are distinguished from production networks and identified as knowledge networks by Gelsing (1989), who categorised ‘industrial networks’ as including the following types: i) user-supplier relationships, ii) the production chain or the value added (vertical) chain, iii) production complexes (*filières*) with a focus on the exchange of material resources, and iv) knowledge networks, with a focus on information and knowledge exchange. Later he (1992: 117) made an analytical distinction between the ‘trade network’ as “linkages between users and producers of traded goods and services”³⁸ and the ‘knowledge network’ as “the flow of information and exchange of knowledge irrespective of its connection to the flow of goods”. Therefore, the knowledge network comprises not only marketed information (such as staff training programmes, market analyses, technical advice, and tangible goods) but also the informal exchange of ideas (for example, among technicians regarding non-standard technical problems, or among purchasing personnel regarding suppliers of special components) (Gelsing 1989; see also von Hippel 1988).

A related literature identifies lessons for the emerging market countries. For instance, Hobday (1994) examined ‘dynamic networks’ to explain the key features of technological learning and innovation in the context of a ‘latecomer firm’ in the catching-up countries. Several recent studies on knowledge networks highlight the two-way relationship between being involved in knowledge networks and increases in the

³⁷ An analogy to the ‘make or buy’ decision of the firm in transaction-cost economics.

³⁸ In fact, GVC research is solely based on such relationships in international trade, with learning effects on the suppliers’ side. The GVC researchers take these relationships in the broadest sense of the word, as once described by Richardson (1972: 883) as “the dense network of co-operation and affiliation by which firms are inter-related” (see Humphrey 2001: 11).

level of capabilities of the firm (Dantas and Bell 2009, 2011, Yoruk 2011). Most importantly, these networks do not necessarily involve power relations and do not evolve within a linear structure; instead they have a primary focus on issues such as knowledge acquisition, technology transfer and learning by firms.

2.3.2 Linking Networks to Firm-level Upgrading through Learning

McDermott and Corredoira (2010) argue that in the context of emerging markets firm-level upgrading is not a product of market liberalisation or development of technological capabilities but rather of certain types of organisational relationships.³⁹ Given the importance of the abovementioned non-governance related networks as a source of knowledge and technology, this research regards as more important for firm-level upgrading the quality-related characteristics of the relationships the firms are involved in (rather than the number of relationships) as well as the ways in which, and the extent to which, they lead to learning. In order to explore this link between networks as sources of knowledge and learning and firm-level upgrading, this research makes use of the learning literature developed within the evolutionary school.

2.3.2.1 Learning in the developing country context

Prior research in developing countries stresses the role of high dependence on foreign technology ‘acquisition’ from developed countries, which does not require more than operational production capabilities (Dahlman and Fonseca 1987, Bell and Pavitt, 1993, 1995, Kim 1980, 1997). In his work on Korean industries, Kim (1980) found a general pattern of learning processes, which he referred to as a three-phase catch-up model, that proceeds from ‘implementation’ of imported or licensed technology to ‘assimilation’ through the acquisition of abilities for process development and product design technologies and eventually to ‘improvement’ through the application of R&D to produce new product lines (i.e. reverse-engineering) in order to strengthen competitiveness. His work revealed that this way the sequence of learning is reversed when compared to developed countries (Kim 1997). His model was developed, tested and confirmed by other authors on local and foreign-owned firms in other East Asian countries (Lee *et al.* 1988, Hobday 1995a, b, & c).

³⁹ In their work, following GVC framework, they refer to relationships in which power relations are most often not equally distributed.

In the context of the emerging market firm as the ‘recipient’, the dynamic of the network activities (whether to develop a new product, process or technology, to establish product-market competition, to make use of resource complementarities between partners, or to source knowledge) has significant implications for tapping into new knowledge and exploiting opportunities for capability development and firm-level upgrading. In other words, the emerging market firms in these networks pursue learning rather than complementarity of capabilities in the network (Mowery *et al.* 1996).

Hobday’s (1995b & c) model of the OEM-ODM-OBM learning trajectory of the latecomer firm in ‘dynamic’ production networks shows this in four stages of organisational upgrading with a technological dimension. In his GVC framework, Gereffi (1999b) uses the same trajectory to explain the process of initially manufacturing for low-end markets (as OEMs), then moving up to more demanding and sophisticated markets (as ODMs), and then to high value-added markets (as OBM). When the firm functions in all these stages simultaneously, it is referred as ‘operating in multiple chains’ in the upgrading literature (Schmitz 2006, Navas-Aleman 2011). Gereffi (1999b: 15) views these “sequences of export roles [as] contingent, not invariant, features of industrial upgrading” and argues that “success in one role does not guarantee success in subsequent ones”. That is what findings have proven so far through empirical studies that use the GVC framework (among others Gereffi 1994, 1999a, 1999b, Kessler 1999, Ramaswamy and Gereffi 2000, Schmitz 1999, Schmitz and Knorringa 2000, Pietrobelli and Rabellotti 2004); in other words, firms in different regions and in different industries show different learning patterns of upgrading (Hobday 1995c, 1998, Yoruk 2004, Pickles *et al.* 2006, Smith *et al.* 2008).

Hobday’s model also showed the importance of incremental and minor improvements for catching up with developed country firms not through conventional ‘learning by doing’ (Arrow 1962) but through ‘technological learning’ which requires “substantial and deliberate effort and investment on the part of firms” (Hobday 1995b: 33, 2003). Kim (1997, 1999b, 2001) refers to this as the ‘intensity of effort’ component of Cohen and Levinthal’s (1989, 1990) ‘absorptive capacity’, which refers to the ability through which external knowledge is internalised and in-house R&D activities involve not only

new knowledge generation but also assimilation of external S&T.⁴⁰ Since then, the concept of learning has often been associated with innovation processes through which new knowledge is acquired, assimilated and generated (Lundvall 2001), and a literature on learning has been developed within the evolutionary school.

2.3.2.2 Learning Literature

As a pioneer of the resource-based view of the firm, Penrose (1959) mentioned the need not only for prior knowledge but also for the capacity to obtain knowledge, i.e. to learn to adapt to changing business environments and to grow.⁴¹ The evolutionary economists took Penrose's work as one of the bases for explaining the accumulation of firm capabilities through learning. They defined learning as a social activity that is based on interaction between people; an informal, cumulative, qualitative, idiosyncratic process with uncertain outcomes and a dynamic system embedded in everyday routines and reproduction (Lundvall 1992c; Malerba 1992, Hobday 1995c). Learning allows the firm to build its knowledge base on technologies, products and processes and to further increase its stock of knowledge, reflected in the better use of the broad skills of their workforce and improvements in the firm's capabilities, which in turn generate substantive advancement in the firm and its environment (Dodgson 1990, Malerba 1992).

Building upon this view and based on a literature survey of the long tradition of empirical case studies on learning curves that are associated with 'learning-by-doing' and an empirical analysis of learning by firms in the American manufacturing industry, Malerba (1992) points to the fact that firms learn in a variety of different ways, which are linked to different sources of knowledge and take place in different units of the firm, i.e. not only in the R&D unit but also in production, design, engineering, organisation and marketing. He proposes a learning taxonomy for the producer firm: Learning internal to the firm (i.e. generated directly from the firm activities, such as production, R&D, marketing) or external to the firm (i.e. from sources outside the firm, such as

⁴⁰ In their seminal paper, Cohen and Levinthal (1990: 128) argue "that the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities". They label this capability as "a firm's absorptive capacity and suggest that it is largely a function of the firm's level of prior related knowledge", which Kim calls (1997, 1999b, 2001) the 'prior knowledge base of the firm'.

⁴¹ Penrose (1959) stressed the existence of a dynamic interaction between the external and internal environments, which creates opportunities for diversification, but she did not go into detail about the external environments in pursuit of the main argument of her book, i.e. internal expansion.

Table 2.2 The Learning Mechanisms in Networks as derived from the literature

Sources of knowledge (von Tunzelmann and Wang 2007)	Taxonomy of learning (Malerba 1992) [with some additions from the literature]	Definition of the learning category (as derived from Malerba (1992) and von Tunzelmann and Wang (2007))
Learning external to the firm		
From production	Learning by spillovers	Learning from activities of what competitors and other horizontally-related firms in the industry are doing
From consumption	Learning by interacting	Learning by actually interacting with upstream suppliers or downstream customers, users, and with other firms/organisations in the industry (Lundvall 1988, 1992c; von Hippel 1988)
From search 'supply'	Learning from advances in S&T and education	Absorbing new developments in S&T, particularly in close cooperation with suppliers of technology and skills (e.g. universities, research labs)
Learning internal to the firm		
From production	Learning by doing	Learning through experience associated with production activity, assumed to be a passive, automatic and costless learning process (Arrow 1962);
	Learning by imitating	Learning generated by trying to imitate the existing processes or products of customers or competitors by the own efforts of the firm, which is used interchangeably with <i>learning from rivals</i> (e.g. Geroski and Mazzucato, 2002);
	Learning by failing	Learning from the mistakes and trying not to repeat them (e.g. Arino and de la Torre, 1998).
From consumption	Learning by using	Learning associated with use of what is supplied, e.g., products, machinery and inputs (Rosenberg 1982);
	Learning by monitoring	Learning generated by monitoring what customers and suppliers are doing in the industry (Sabel 1994) (impact on quality improvements in product and production processes) and what competitors are doing in the industry (impact on imitative effects on products, marketing, technology, and management)
From search 'supply'	Learning from searching	Learning identified with in-house R&D activity of the firm that aims at new knowledge generation, involving interaction with and learning from technology suppliers (Nelson and Winter 1982, Dosi 1988);
	Learning by research;	Knowledge search by an in-house research unit using scientific and technological means of research to overcome a problem, to develop a new process or products, to improve a technique or to teach the newest information to employees and trainees (e.g. Kim 1998a).
	Learning by training/R&D	Learning generated through formal search processes which are in-house R&D and internal training (von Tunzelmann and Wang 2007)

Source: Based on von Tunzelmann and Wang (2007) and Malerba (1992), and the relevant learning literature.

other firms within the industry, suppliers or users, and new advances in science and technology). Learning internal to the firm is composed of Arrow's (1962) learning by doing,⁴² Rosenberg's (1982) learning by using and learning by searching (Nelson and

⁴² Bell (1984: 189) explains the three drawbacks of doing-based type of learning (mentioned in the definition column in Table 2.2): "First, it arises quite *passively*. Little or no explicit actions are required to capture the increased knowledge/skill and whatever benefits flow from that acquisition. Second, the learning process is virtually *automatic*. Given a period of 'doing', some quantum of learning will take place. Third, it is *costless*. Learning is acquired simply as a free by-product from carrying on with production, no expenditure beyond that needed for production is required to generate the increased knowledge and skill".

Winter 1982; Dosi 1988). Learning external to the firm is composed of learning from inter-industry spillovers, learning from advances in science and technology, and learning by interacting (Lundvall 1988; von Hippel 1988). Due to lack of space definitions of learning mechanisms are inserted in Table 2.2.

Malerba (1992) points out that various types of learning processes may co-exist or be closely interrelated. In their effort to develop a production theory which involves Schumpeterian dynamic competition (i.e. quality or innovation), von Tunzelmann and Wang (2007) clarified the sources of knowledge for learning internal and external to the firm in relation to producer, consumer and supplier (Table 2.2). In doing so, they defined the types of agents expected to play a role in learning mechanisms external to the firm. They argue that production activities generate learning both internally through ‘learning-by-doing’ of the classic Arrow kind (1962), and externally through spillovers from competitors and horizontally-related firms. Consumption activities generate learning internally through ‘learning-by-using’ of what is supplied and externally through learning by actually interacting with suppliers or users. Associated with suppliers of technology and skills, formal search processes generate learning internally through in-house R&D and training and externally through education (universities) and advances in S&T (laboratories).

In the literature, there are a couple other useful additions to Malerba’s taxonomy that can be categorised within learning internal to the firm. These are *learning by monitoring* (Sabel 1994, Helper *et al.* 2000),⁴³ *learning by imitating / learning from rivals* (e.g. Geroski and Mazzucato, 2002), *learning by failing* (e.g. Arino and de la Torre, 1998), and *learning by research* (Kim 1998a). The roots of this last learning type lie in Kim’s (1980) three-phase model of catch-up mentioned above.

2.3.2.3 Linking Learning to Firm-level Upgrading

Drawing on networks as source of knowledge and learning, learning external to the firm appears to be about developing the ability to *identify and acquire* these new, potentially useful and valuable ideas and knowledge while in a relationship. It is not automatic (i.e.

⁴³ There are spillovers from different agents in the economy such as intra-industry as well as inter-industry actors, universities, industrial and scientific research institutes and FDI, which are not specifically mentioned in the learning literature but have been left to the spillover literature. This gap between learning and spillovers is worth researching in another study.

being involved in a network does not necessarily mean that there is knowledge transfer); nor is it an easy process, due to the difficulty of transmitting tacit knowledge in comparison to codified knowledge (Polanyi 1967). Drawing on the lessons from developing country firms in the learning literature, it necessitates complementary internal learning processes, namely ‘absorptive capacity’ (Von Tunzelmann and Wang 2007, Kim 1999b). Describing organisational learning as a function of absorptive capacity, Kim (1999a: 507) argues that the firm requires ‘learning capability’, defined as “the capacity to assimilate knowledge (for imitation)” and “develops problem-solving skills that represent a capacity to create new knowledge (for innovation)”. He (1998) stresses the importance of combining external and internal learning mechanisms effectively through mobility of skilled labour (e.g. receiving technical training during purchase of packaged technology) and heavy investment in in-house R&D in the sense of learning by research discussed above.

Kim’s analysis has been constrained to the technological aspects of these improvements. The organisational aspects are not given the attention they deserve as they are less easily transmitted due to their more tacit and context-based character (Edquist *et al.* 2001). This brings us to functional upgrading, about which there is controversy in the upgrading literature with regard to the failure of local supplier firms in GVCs to upgrade beyond the sphere of production (Schmitz 2006). Some studies suggest that operating in multiple chains allows firms to upgrade functionally, while buyer resistance and resource requirements create obstacles to some other firms. What these studies have overlooked or forgotten is that there are different ways of learning, as the learning literature argues above, with different outcomes, as Hobday (1995a) and Kim (1998a) have shown in their seminal works.

2.4 CONCLUSION

This chapter first reviewed the upgrading literature within the frameworks that have emerged and developed in the last twenty years. It also examined the differences and similarities between these frameworks in their approaches to particular issues in the upgrading literature such as governance, networks and learning. This helped identifying the limitations of the upgrading literature which resulting from the transaction costs approach, particularly in the GVC framework. The comprehensive approach of the GPN framework to firm-level upgrading appeared to overcome some of these limitations and

pay more attention to the issues that this research examines than the GVC framework, such as knowledge transfer and learning from actors outside the value / production chain. However, there are separate literatures that dwell on these processes in relevant contexts rather than within GPNs. This chapter also reviewed the systemic origins of networks and network theories of the firm that view networks as source of knowledge and learning as well as the learning literature from an evolutionary perspective. As a result, it has developed a theoretical framework for creating a basis for operationalising knowledge transfer and learning in both production and knowledge systems. In the light of this, the next chapter will propose an operational definition of upgrading and incorporate evolutionary perspectives into the upgrading literature within a novel analytical framework for the further development of this literature.

Chapter 3 ANALYTICAL FRAMEWORK AND ITS KEY CONCEPTS

3.1 INTRODUCTION

This thesis aims at investigating how firm-level upgrading takes place through involvement in networks in LMT industries in emerging markets. Chapter 2 reviewed the existing literature and established the theoretical framework of this thesis. This chapter proposes an analytical framework. This research adopts an evolutionary approach to firm-level upgrading. It is therefore essential to clarify the key terms that are going to be used throughout the thesis and establish the framework within which they are going to be analysed. With this aim in mind, this chapter establishes the boundaries of the research problem tackled in this thesis within a dynamic model of firm-level upgrading. Hence, the analytical framework of this research integrates a new perspective into the upgrading literature.

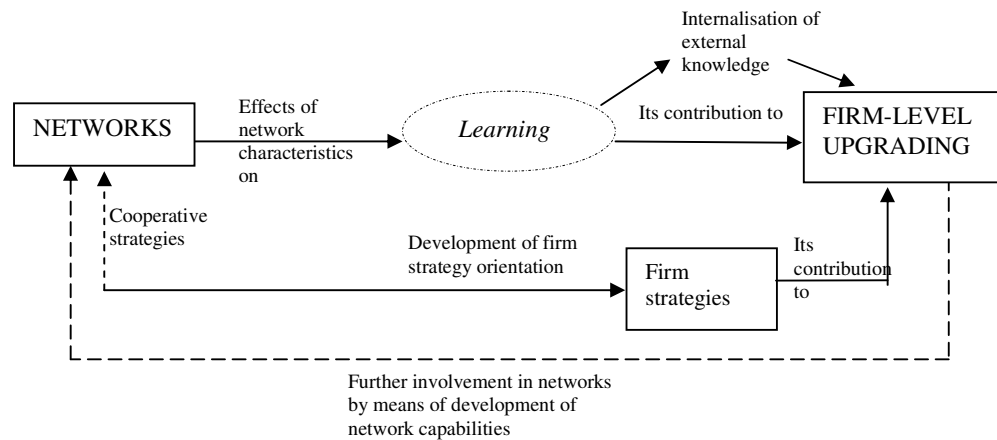
This chapter explores a number of conceptual issues that seem to be necessary in moving forward to build a deeper understanding of firm-level upgrading in LMT industries in emerging markets. These issues are related to the need for going beyond the narrow approach of the upgrading literature to the concepts of ‘networks’ and ‘learning’ so as to link network involvement to firm-level upgrading. “Networks offer ideal upgrading conditions” (Giuliani *et al.* 2005: 552), but *how* do networks enhance upgrading conditions? In other words, the main research question of this research: *How does involvement in networks bring about firm-level upgrading?*

Building upon the abovementioned work of Hobday and Ernst, who developed the link between IU and GPNs within the context of international knowledge transfer and diffusion, this research proposes a ‘dynamic approach’ (à la Langlois 1992) to firm-level upgrading by recognizing the impact of different ways of learning in the upgrading of the firm’s organisation- and technology-related functions through its network activities. Originating from evolutionary economics, such an approach to upgrading incorporates non-hierarchical, non-linear relations with higher opportunities for learning capabilities into the upgrading concept.

Figure 3.1 depicts the analytical framework of this research which is based on a dynamic model of firm-level upgrading. It highlights the role of networks in upgrading

of the firm through inter-organisational and intra-organisational learning successively. Intra-organisational learning is confined to issues directly related to the assimilation of information and knowledge from inter-organisational networks. It also highlights the role of firm strategies in upgrading of the firm as a factor on its own right. The solid arrows represent the direct effects between networks, learning and firm-level upgrading; indicating that the motivation in learning in networks is to attain upgrading.

Figure 3.1 The analytical framework: A Dynamic Model of Firm-level Upgrading



Source: Author

The two-way arrows between networks and firm strategies illustrate the assumption of cooperative strategies in the firm's involvement in networks (from firm strategies to network, the dashed part) as well as the influence of relationships in development of firm strategies of a specific orientation (from networks to firm strategies).⁴⁴ The arrows from firm strategy to firm-level upgrading capture the impact of the strategic orientation on firm-level upgrading. The dashed arrows from firm strategy and firm-level upgrading to networks indicate the dynamic interaction between these variables and networks, which are acknowledged but kept outside the scope of this research. Westney (1988: 340) stresses the importance of learning as a goal in cooperative strategies in a firm's ability to learn how to manage its networks effectively:

⁴⁴ In the literature to date, networks have been used to describe and analyse dynamic aspects of industrial systems. However, they are an essential part of the strategies pursued by firms in such systems, because they are not only a way to mobilise and coordinate external resources (Håkansson 1987), but also evolve in response to the firm's changing resource needs and resource acquisition challenges (Hite and Hesterly 2001). They are also a means for emerging market firms to understand different forms of organisations and their impacts on the organisation of the firm. Firms started developing networks as a corporate strategy in the 1980s with the changing nature of production processes in the developed countries so as to gain access to the knowledge, resources and capabilities they lacked.

“[w]hen the boundaries of its industry are shifting, the firm must adopt a learning strategy in at least some of its relationships with external organisations, both within and beyond the borders of its home country, if it is to make a successful transition”.

The dashed arrows from firm-level upgrading to networks are part of the virtuous cycle between them, where networking facilitates the upgrading of the firms (the concern of this research), and at the same time upgraded firms attract further networking opportunities and the firm's attainment of a higher level of upgrading from a new relationship can orient it to searching for ways in which further upgrading could be achieved. This, however, may not be attainable without internalisation of externally acquired knowledge and firm strategies.

As this analytical framework shows, this thesis aims at contributing to the upgrading literature by filling the gap between network involvement and firm-level upgrading with a deeper look into the concept of learning in an inter-organisational context and its integration at the intra-organisational level. Building on the theoretical work discussed in Chapter 2, it argues that upgrading possibilities for an emerging-market firm rest upon learning in networks; and this framework indicates that only after ascertaining *what* influences learning in networks can we know *how* learning in networks contributes to firm-level upgrading, through the characteristics and processes pertaining to the relationships. In this manner, firm-level upgrading is a function of learning in networks.

Moreover, as this analytical framework shows, the main focus of this research will be on the role of external dynamics of the firm, albeit without ignoring the internal dynamics mediating between external dynamics and the firm-level upgrading (Penrose 1959, Yoruk 2003). The authors of upgrading studies also acknowledge that upgrading is not automatic and requires investment by the firms in their people, organisation and equipment. But they argue that local producers' indigenous efforts are rarely enough (Humphrey and Schmitz 2004b). However, this area is left un-researched. In addition, *firm strategies* for upgrading purposes, a significant but overlooked concept in the upgrading literature, are examined as one of the network-related sources of firm-level upgrading.

3.2 NETWORKS

This research considers networks as the external source of upgrading in the firm. In contrast to the recent upgrading literature, it argues that in reality GVCs and GPNs do not cover the entire external linkages of the firm. As the reasons were widely explored in sub-section 2.2.3 and the network literature was examined in sub-section 2.3.1, there is need for a broader perspective on networks to understand why and how the interactive relationships that transfer knowledge lead to upgrading in the firm.

A broader network approach aims to extend the analysis beyond value chains. While GVCs / GPNs are about coordination of relationships and knowledge transfer in globally-dispersed production networks, a broader approach also encompasses networks of knowledge-related flows in sectors between firms and other organisations within the local, national or international domain that enable firms to access various knowledge sources, to improve their existing capabilities, to develop new competencies through knowledge transfer and to enhance their upgrading strategies. Following evolutionary insights into networks, this research builds its analysis of firm-level upgrading on networks embedded within both production and knowledge systems.

The first section defines networks and the second section establishes the types of networks this research is interested in, to develop a systematic understanding of the role of networks in firm-level upgrading.

3.2.1 Definition of Networks

This research adopts a definition of networks as a mode of cooperation including “all forms of collective action that do not primarily involve either financial exchange (markets) or the exercise of power (hierarchies)” (Von Tunzelmann 2010a: 8). In other words, it is interested in networks as a source of knowledge, technology and skills among partners who “sought [networks] as a way to tap into another firm’s capabilities or to share information” (Kogut *et al.* 1993: 70-71). This definition does not necessarily contradict the real world practice that every knowledge exchange through networks involves, to some degree, elements of market exchange and power imbalance, particularly in the case of collaboration that leads to transfer and development of knowledge associated with production and technology (Von Tunzelmann 2010a).

Therefore, although this research is not interested in power relations among the partners that are strongly characterised by some form of hierarchy, it is not possible to fully eliminate the discussion of governance when GVCs/ GPNs are considered. In fact, network theorists such as Powell (1990) argue that networks are characterised by the dependence of one party on resources controlled by another in reciprocal, preferential, and mutually supportive relationships, with explicit gains from the pooling of the resources of these two parties. Håkansson (1989) defines three components of an industrial network – actors, resources and activities – that are linked to each other within industrial systems by means of control (actors control resources), performance (actors perform activities) and consumption of other resources (activities change or exchange resources through use of other resources).

Especially with regard to firm-level upgrading (a concept with a strong qualitative dimension) through networks, these non-market linkages make the transfer, not just of technologies (i.e. machine-centred technological change), but of knowledge (for production, distribution, marketing, innovation, etc.) relevant for successful upgrading (Dyker and von Tunzelmann 2002). Thus networks, as based on non-market exchanges positioned outside the monetary system, become a matter of quality.

3.2.2 Types of Networks

Researchers tend to categorise networks in line with their analytical and/or empirical focus (Hess 2008). In this research, there is a need to look at a wide variety of networking activities of firms for networks to become an essential tool for identifying the evolution of firms' upgrading potential (Bell & Albu 1999). Hence, the choice of network types is an important part of the analytical framework of this research.

Uzzi (1997) uses the ‘embeddedness’ of relationships to group the wide variety of relationships in networks into two sets: embedded ties and arm’s length ties. Therefore,

“[o]n one hand, networks constituted of embedded ties benefit from trust, joint problem solving, and thick information exchange, which enhance coordination and resource sharing. On the other hand, networks composed of arm’s length ties have wide access to information circulating in the market and an enlarged ability to test new trading partners” (Uzzi 1996: 684).

The latter is based on arm’s length ties’ ability to help firms

“disperse their business among many competitors, widely sampling prices and avoiding small-numbers bargaining situations that can entrap them in inefficient relationships (Hirschman 1970)” (Uzzi 1997: 36).

In addition, Uzzi (1996: 685) suggests that

“networks consisting of a mix of arm’s length and embedded ties have the greatest adaptive capacity because embedded ties facilitate coordination and resource pooling, while arm’s length ties prevent the network’s insulation from market imperatives”.

So, a firm’s networks ideally cover both embedded and arm’s length ties in inter-relations among individuals and firms, and between firms and other organisations, in the areas of market, business, production, technology, innovation, etc. that allow knowledge transfer between the parties involved. This knowledge transfer is often aimed at changing quality rather than quantity. In fact, although arm’s length relations (AL) generally represent pure market transactions, the literature suggests that networks can evolve out of market relationships among various parties (Powell 1990), and can lead to substantial capability development in the firm. AL relations (in the form of technology transfer) help to develop skills in design, engineering and project management, to generate change in technological capabilities, and to accumulate ‘problem-solving capabilities’ (Dosi 1988) and (in other forms) can be efficient means of transferring codified knowledge as well as knowledge embodied in a product (Demsetz 1991, Inkpen 1998). Similarly, Humphrey and Schmitz (2004: 367) have detected that

“[m]arket-based relationships in the (large) domestic market enabled substantial capabilities in design and marketing to be built up, and Brazilian producers were then able to export to the Latin American market products which they had designed and branded”.

These types of AL relations are included in this research, in addition to networks that are categorised as production, distribution and knowledge networks, so as to assess their impact on firm-level upgrading.⁴⁵ In the context of international technology transfer, Kim’s (1999a, b) distinction of market- and non-market-mediated ties with foreign technology suppliers provides us with the relevant examples for AL relations. He refers to technology transfers that involve written agreement and payment between the partners as market-mediated (i.e. AL relations in this research) and exemplifies them as foreign direct investment,⁴⁶ foreign licensing, turnkey plants, technical consultancy, made-to-order machinery and import of machinery and equipment. However, technical

⁴⁵ In the econometric analysis, AL relations will serve as a control variable against production and knowledge networks.

⁴⁶ FDI represents hierarchy (equity-based relationships), and so is out of the scope of this research.

assistance by foreign buyers and by foreign vendors exemplify non-market-mediated technology transfers.

Therefore, this research by and large typifies relationships on the basis of the embeddedness of ties in networks, distinguishing arms' length from embedded ties (Uzzi 1996, 1997), and on the basis of the systemic origins of networks, distinguishing knowledge systems from production systems (Bell and Albu 1999). Table 3.1 presents the derivation of the type of relationships used in this research from the upgrading and networks literatures based on the embeddedness of ties in networks and their systemic origins.

Table 3.1 Types of relationships used in this research and the literature they derive from⁴⁷

<i>Embeddedness of relationships in networks (Uzzi 1996, 1997)</i>	Arm's length ties	Embedded ties		
<i>Systemic origins of networks (Bell and Albu 1999)</i>		Production systems	Knowledge systems	
Humphrey and Schmitz (2004a, 2004b)	Arm's length market relations	Networks; Quasi-hierarchy		<i>Hierarchy</i>
Gereffi et al. (2005)	Markets	Modular, Relational, Captive value chains		<i>Hierarchy</i>
Ernst (1997)	Standard coalitions	Supplier, producer, customer networks	Technology cooperation networks	
Ernst (2006, 2007, 2009)		Global Production Networks	Global Knowledge Networks, Global Innovation Networks	
Michalet (1991)		Hollow corporation or Network firm	Alliances	
Coombs & Metcalfe (2000)	Predominantly market-mediated relations	Multi-firm collaborations with the special purpose of producing generic knowledge	Application-oriented collaborations + Strategic alliances	<i>Joint ventures</i>
Gelsing (1989, 1992)	Trade networks (user-supplier relationships)	Production chain or the value added (vertical chain), + Production complexes (filières)	Knowledge networks	
THIS RESEARCH	<i>Arm's length relations</i>	<i>Production and distribution networks</i>	<i>Knowledge networks</i>	

Source: Literature review in Chapter 2.

⁴⁷ For more explanation of the references of this Table, see Appendix B.2.

As network arrangements usually involve only non-equity forms of control, this research excludes hierarchies from its analysis (except foreign strategic investors with less than 50% of the shares). Non-equity-based relationships are more flexible, but still require a relatively strong commitment and inter-organisational interdependence (Duysters and Hagedoorn 2000). Therefore, this research treats the category of ‘quasi-hierarchic’ relationships in the upgrading literature (Humphrey and Schmitz 2004, Gereffi *et al.* 2005) as embedded ties within production networks.

As can be seen in Table 3.1, this research categorises networks as production networks, distribution networks and knowledge networks. Production systems involve production (supply side) and distribution networks (demand side) (cf. von Tunzelmann and Wang 2007, in relation to production and consumption as source of knowledge respectively). Production networks are supplier / producer / customer relationships that cover a series of exchanges of information, resources, products and services over a period of time with specifications of the terms and responsibilities of the each partner. In other words, they comprise value chains and production networks discussed in the literature.

Distribution networks with local firms are opportunities to enter new markets for foreign firms, especially when compared to mergers and acquisitions (M&As) and JVs (Garette and Dussauge 2000). They allow the foreign partner to have access to the specific market knowledge of local partners with less effort and time put into learning how to succeed in very different local environments, while the local partner learns about a new area of firm activities. Cooperative marketing activities take place within production systems and were a focus of attention in the studies of industrial networks by the Uppsala School. Schmitz (2006) argues that the GVC approach provides clear hypotheses with regard to distribution gains but the empirical evidence remains weak.

The works of evolutionary economists on networks focuses on the knowledge networks that are related to increasing the knowledge stock or base of the firm (Bell and Pavitt 1993, Kim 1998a) through embedded ties within the knowledge systems. For the purposes of this research, production and knowledge networks are not mutually exclusive and incompatible; in most cases, they are complementary in terms of the positive learning externalities created in production and knowledge systems (Michalet

1991). As firms manage to broaden their relationships within both systems, the interactions among individuals allow them to understand the capabilities and knowledge embedded in the external environment. They will want to tap into these external sources of knowledge and capabilities, share information and knowledge among partners and produce knowledge and innovation through interaction (e.g. ‘networks of learning’ in Powell *et al.* 1996; Kogut *et al.* 1993, Inkpen and Crossan 1995, Doz 1996, Mowery *et al.* 1996), with positive effects on the cumulativeness of not only individual absorptive capacity but also organisational upgrading.

3.3 FIRM-LEVEL UPGRADING

3.3.1 Definition of Firm-level Upgrading Revisited

Firm-level upgrading can not be narrowed down to *moving up* from one position to another in the value chain (see also Ponte and Ewert 2009) or in comparison with competitors, as argued in the upgrading literature.⁴⁸ It is preferable to view it as a move from being less competitive to being more competitive, from being less competent for efficient resource acquisition and allocation to being more competent, and from being a low level learning organisation to being high level. Therefore, in these senses, firm-level upgrading can be considered as a building block or step towards the growth of the firm.

Drawing partly on Meyer-Stamer’s definition of upgrading and borrowing types of upgrading from Humphrey and Schmitz, an operational definition of upgrading can be put as follows: Firm-level upgrading in general refers to the process of gradually acquiring, or enhancing, the deficient intangible assets that enable firms to do things differently and/or better and to do different things as compared to the previous context

⁴⁸ If downgrading is practised as a part of firm strategy, mostly for reasons of survival, it may still provide learning and upgrading (particularly, in the case of transition country firms, expected to provide managerial upgrading, to which none of the contributors assign importance); a good example is the Hungarian electronics firm Videoton, see Szalavetz (1997) and Radošević and Yoruk (2001). Downgrading is not addressed in this research explicitly; the clothing firms involved in this study had already experienced downgrading with the transition from planned to market economies. Throughout the transition years, they were all interested in upgrading either to their previous positions in their market or to the level of their foreign or local competitors. Among the food-processing firms there were firms that downgraded for survival reasons to a position of being suppliers to hypermarkets’ own label products.

of the firms' environment.⁴⁹ With this definition, knowledge transfer and learning through networks become a key, inherent source of upgrading in the emerging market firm, as it paves the way for improving technological and organisational deficiencies in the knowledge base of the firm.

In the context of emerging market firm, it is about the distinction between to learn how to do something that was already created in a different way, but not necessarily to create it and to learn how to create something (see Kogut and Zander 1992:391 regarding "being taught to do something and being taught to create something"). Hence, firm-level upgrading becomes, at least in the transition years, more about *adoption and utilisation*, and less about *creation*, of new and existing technology and knowledge, and it benefits from the effective *diffusion* of technology and knowledge. "[W]hile firm's processing of knowledge is itself unobservable, it nevertheless influences other, more readily observable organisational practices (Schein 1985)" (Lane and Lubatkin 1998: 465), as manifests itself in minor improvements to products, to more efficient and flexible processes, and later the introduction of new variations of products (Hobday 2003).⁵⁰ Drawing on the literature on learning in developing countries, these minor changes appear to be the key sources of upgrading in the emerging market firms. To catch up, keep up and go ahead, one must keep abreast of the pace of changes in the industrial environment. This requires the firm to be aware of these changes and willing

⁴⁹ For instance, in comparison to what the transition country firms used to do in planned economies, rather than as compared to their rivals as suggested by Meyer-Stamer that requires an analytical framework with different measures and unit of analysis than used in this research.

⁵⁰ The question set by Edquist *et al.* (2001:13) regarding the definition of innovation explains what I mean: "In the case of a new microprocessor it is easy. But what about a new flavour of sausage?". The definition of innovation leaves out changes in products and processes which are purely aesthetic (such as changes in colour or decoration), or which simply involve product differentiation (minor design or presentation changes which differentiate the product while leaving it technically unchanged in construction or performance) or which do not have a sufficient degree of novelty. Three examples (particularly related to the industries examined in this study) from the Community Innovation Survey (1997) questionnaires are: 1) Change in clothing production is treated as a matter of fashion and a key element in clothing firms' competitiveness. Introduction of the latest colour and cut do not change the essential characteristics or performance of clothing (e.g. keeping the body at an appropriate temperature, be comfortable to wear and easy to maintain, etc.). Technologically improved products here almost always involve the use of new materials diffused by the textile industry and, before that, the chemical industry (e.g. the introduction of drip-dry shirts, or 'breathable' waterproof mountain gear, is a technological product innovation). 2) The implementation of a quality standard such as ISO 9000 is not technological innovation unless it is directly related to the introduction of technologically new or significantly improved product or processes by means of increasing the quality of the products. 3) The re-titling or repackaging of an existing soft drink popular with older people, to establish a link with a football team in order to reach the youth market, is not a technological innovation, but counts as marketing. These minor improvements that are not treated as innovations may have significant bearing on the upgrading of the firms.

to learn and adapt to these changes. This is why this research is concerned with interaction with other firms and organisations for external knowledge sourcing and the assimilation of what is learnt in those networks.

Figure 3.1 illustrates that successful upgrading in the emerging market firm is based on:

- 1) Access to external knowledge;
- 2) The ability to recognise, value and assimilate new external knowledge (Cohen and Levinthal 1989, 1990; Lane and Lubatkin 1998); and
- 3) Firm strategies for access and optimal use of the external knowledge.

The approach of this research to firm-level upgrading is primarily concerned with knowledge acquisition and internalisation for technological and organisational improvements in the firm, and not with measuring upgrading. Therefore, the typology of upgrading as described by Humphrey and Schmitz (2004a), to which I now turn, is the most suitable categorisation of the firm-level upgrading for operationalisation purposes of this research.

3.3.2 Types of Firm-level Upgrading

This study adopts Humphrey and Schmitz's (2004a) typology of upgrading with some changes and adaptations.⁵¹ Their upgrading types are not only standard categories that are applicable to any sector but also empirically easy to use, particularly when compared to Hobday's upgrading trajectory of OEM-ODM-OBM which is more suitable for buyer-driven GVCs/GPNs. Here, they are re-defined in association with the characteristics of firm-level upgrading discussed above. These definitions are available in Table 4.11 in section 4.5.2.1 of Chapter 4.

Process upgrading is about new improved production processes for existing products through minor changes in equipment or organisation of production, and about completely new production processes for making new products. Product upgrading is partly about 'creative imitation' (Kim 1997) of an existing product and partly about the ability of the firm to introduce a new product to its market with minor or major changes

⁵¹ I leave out inter-sectoral upgrading, which is not relevant to the scope of this research, for reasons of the geography and time period concerned, as well as due to the fact that too little time had elapsed in transition countries at the time of the research for the realisation of chain upgrading.

in the formulation and/or packaging of the product and/or with the use of new technology (produced by the firm or imported abroad). It covers the expansion of the business via product diversification and/or differentiation (adding new product categories) and via consumer differentiation (targeting of new consumer categories). It involves the commercial introduction of a new or technically changed product that includes aesthetic or minor design changes.⁵²

As Freeman (1994) notes, there are industries that do not require R&D for innovativeness, particularly those in which organisational innovations are more important than technical innovations (see also von Tunzelmann and Acha 2005).⁵³ Instead the introduction of new and different firm functions, competences and strategies is what firms operating in these industries need. This includes functional upgrading. Particularly in emerging markets the functions involved cover anything other than production capability, such as design, purchasing, sales, marketing and distribution. Scholars point out the importance of technological changes in the organisational dimension in encouraging ‘the endogenisation of change itself’. Only when these technological changes do not represent a once-and-for-all change in production, they lead to transformation of firms into dynamic learning organisations (Kaplinsky and Hoffman 1992, Radošević 1999a). The changes new technologies cause in “the basic parameters of designing, producing and marketing industrial products and services”, and which “require significant organisational change”, are what lies at the core of functional upgrading (Radošević 1999a: 79). A firm that achieves functional upgrading normally tends to become a ‘network organiser’ if this is combined with successful management. This brings us to a category of upgrading that is usually overlooked or even forgotten.

⁵² See detailed examples of product and process upgrading for food-processing and clothing industries used in this research in the interview questions in the appendices.

⁵³ In his article on the relationship between innovation and growth, Freeman (1994: 83) stresses that: “Success with innovation depends on many other factors as well as R&D – external relationships, training, integration of design, development, production and marketing functions within the firm, general management quality, the selection environment and so forth. In some industries such as clothing and footwear, fashion design, which is hardly measured in R&D statistics, may be more important than technical innovation. Moreover, R&D statistics do not measure organizational innovations at all, although Schumpeter rightly insisted on their importance and recent research has completely vindicated his view”.

3.3.3 Managerial Upgrading: A contribution to the types of firm-level upgrading within the emerging market context

The discussion of the learning literature mentioned briefly the resource-based view, which emphasises the internal dynamics of the firm. This research integrates this view into the analysis of firm-level upgrading through associating internal dynamics of the firm with its organisational and managerial features. These features play a significant role in firm-level upgrading, particularly in the emerging market firms to compensate their initial disadvantages, e.g. in technological areas (Ernst 2008).

According to the resource-based view of the firm, the development and acquisition of resources and capabilities underlie competitive advantage (Penrose 1959; Barney 1991; Kogut and Zander 1992; Teece *et al.* 1997). This view also stresses the importance of managerial strategies for skill accumulation, knowledge management and learning in developing new capabilities (Wernerfelt 1984; Teece *et al.* 1997). Penrose (1959) views the firm as an administrative organisation that uses its own resources together with other resources acquired from outside. She emphasises that external opportunities and the nature of the internal resources available allow firms to pursue expansion opportunities into new areas. In particular, ‘human resources’ are firm-specific and their effective combination with other resources (inside or outside the firm) is what makes for the firm’s competitiveness. Using own resources effectively is related to managerial ability, i.e. ability to take advantage of all the production possibilities in order to grow the firm.⁵⁴ In a similar fashion, Chandler (1996) stresses ‘the capabilities of managerial hierarchies’, which are composed of a hierarchy of middle and top managers who coordinate, monitor and allocate the combined resources and activities of operating units in a modern firm, as the source of the firm’s ability to reap competitive advantages from economies of scale, scope and reduced transaction costs. Discussions in various literatures refer to the increasing importance of the quality of management as one of the competitive advantages of firms (Doz and Prahalad (1988), to the role of managerial action in shaping networks in an industry as they strategically manoeuvre to secure key positions in these networks (Teece 1996, Madhavan *et al.* 1998), to the joint role of project, R&D, purchasing, marketing and general managers in the innovation process within the firm (Håkansson 1987), and to the importance of technically competent

⁵⁴ The other limitations come out of the conditions outside the firm, which she calls ‘product or factor markets’ and ‘uncertainty and risk’.

senior managers in decision-making (e.g., in choosing the right technology not only relying on the judgement of the experienced engineers but also by evaluating economic profits as well as potential future benefits of technological learning and/or establishing good communication and effective collaboration among internal departments and with sources of external knowledge and potential customers) (Rothwell 1977, Bell and Pavitt 1995). Coombs and Metcalfe (2000) criticise the strong emphasis on the internal factors of firm capability development given by the capabilities-based view of the firm and argue that capability development is related to the division of labour in the generation and exploitation of knowledge (production perspective) as well as the coordination of this division of labour (managerial perspective).

The managerial aspect of firm-level upgrading is less easily transmitted due to its more tacit and contextual character (cf. Edquist *et al.* 2001). In addition, the Community Innovation Surveys (1997) do not count improvements that are not directly related to the introduction of new or significantly improved services or ways of producing or delivering them as innovations. Some of these improvements are related to managerial changes - such as the implementation of advanced management techniques, the introduction of changes in organisational structures, the implementation of new or substantially changed corporate strategic orientations, and the implementation of quality standards such as ISO 9000, and these are expected to be changed, modified or improved by means of networking (Humphrey and Schmitz 2008), particularly because of the lack of adequate resources, experience and expertise.

Referred to as *managerial upgrading*, this upgrading category is defined as “improving the efficiency and effectiveness of production and non-production activities by acquiring new forms of organisational and managerial methods (such as teamwork, training, quality management, changes in perception of business relationships with suppliers, customers, etc.), or by re-organizing the existing managerial activities to facilitate internal and external learning” (Yoruk 2003, 2004). The upgrading literature view the acquisition of new functions as upgrading; however, it does not stress that that functional upgrading requires capabilities to manage. Building upon Penrose’s and Chandler’s contributions, this research draws attention to the neglect of managerial aspects of upgrading, which has vital importance in the development and achievement

of other upgrading types as flexibility in resource allocation and speed in responding to changing circumstances are required by all kinds of companies today.

In emerging market firms, managerial upgrading opens up windows of opportunity of which the firms were previously unaware. The initial observations on the behavioural changes of SOEs in CEECs concern their managers and employees learning the day-to-day running of their enterprise and acquiring substantial independence from the central authorities (Christofides, 1994). As a result, they adjust themselves to the conditions imposed by the transformation so well that in a very short period of time they went from “being producers and insatiable users of inputs (as in socialism) to becoming sellers and asset managers” (Belka 2001:17). Managerial learning has become a key element of transformation, where learning means “not just an acquisition of given knowledge but also its development and modification” (Child and Czegledy 1996: 173).

3.4 LEARNING IN NETWORKS

As explained in the theoretical framework, the learning capabilities of emerging market firms partly depend on a broader technological infrastructure that involves external agents (Freeman and Hagedoorn 1994), and partly on a reverse learning trajectory that takes place inside the firm (Kim 1980, 1997, Hobday 1995a) with varying absorptive capacity levels (Cohen and Levinthal 1989, 1990). The theoretical contributions systematise the learning mechanisms external and internal to the firm and the empirical contributions to the learning literature sheds light on the ‘reverse’ learning trajectory of developing country firms through the networks they were involved in. However, there is a gap in the literature spelled out by Easterby-Smith *et al.* (2008: 687-88) as:

“The implications for the research agenda are that in order to obtain a more comprehensive view of knowledge transfer, studies need to consider both inter- and intra-organizational learning at the same time, and also that there might be value in adopting some of the concepts from related fields such as absorptive capacity”.

As stated earlier, the empirical studies in developing country firms show ‘reverse learning trajectory’ (section 2.3.2.1). Drawing on those studies, this research will define ‘learning in networks’ (Håkansson *et al.* 1999) as the interaction between the two-stage learning process that happen in reverse order: “[T]he ability to exploit knowledge generated by others” as a result of “the firm’s access to this knowledge” (Almeida *et al.* 2003: 303; Inkpen 1998) (i.e. acquisition of new ideas, resources, knowledge or

technology) *and* absorption or internalisation of what is accessed within the firm, referred to as ‘internalisation’ by Hamel (1991) or ‘absorptive capacity’ by Cohen and Levinthal (1989, 1990) as an integrative and/or complementary part of inter-organisational learning (e.g., Ernst *et al.* 1998, Kim 1997, Ernst and Kim 2002).⁵⁵

Chapter 2 reviewed the knowledge acquisition stage of learning in networks. The knowledge internalisation stage consists of transformation processes internal to the firm and is needed for utilisation of the externally acquired knowledge or technology (Zahra and George, 2002). Without this stage, the impact of learning in networks would be limited for firm-level upgrading, particularly for firms that had no capabilities to internalise knowledge before getting involved in networks (Ernst *et al.* 1998, Kim 1997).

Hereinafter, the internal mechanisms used for knowledge assimilation are called ‘internal factors complementary to learning external to the firm’ or ‘complementary internal factors for internalisation of externally acquired knowledge’. This research will examine on these complementary internal factors, showing how firms *share* externally acquired knowledge at different levels of the firm and increase absorptive capacity by means of learning mechanisms *internal* to the firm. These internal factors are expected to have a *mediating effect* that may explain how learning mechanisms external to the firm lead to firm-level upgrading (Baron and Kenney 1986). In this way, firm-level upgrading becomes not only a function of learning mechanisms external to the firm but also a function of learning mechanisms external to the firm and the internal absorption / internalisation processes that follow the acquisition of external knowledge (see Figure 3.1).

⁵⁵Cohen and Levinthal (1989: 569-570) argue that absorptive capacity stems from R&D that not only allows firms “to imitate new process or product innovations” but also “includes the firm’s ability to exploit outside knowledge of a more intermediate sort, such as basic research findings”. In their 1989 article they also use absorptive capacity interchangeably with learning, yet distinguish it from learning-by-doing by the former’s requirement of acquisition of “outside knowledge that will permit it to do something quite different”. They developed the concept of ‘absorptive capacity’ from the experiences of advanced country firms. However, the development trajectory of the developing country firms presents a reverse cycle, as shown by Hobday and Kim (i.e., rather than R&D capabilities helping to develop absorptive capacity, developing country firms attain R&D capabilities through the development of absorptive capacity). This thesis naturally follows the latter route while examining the emerging-market firms.

In a similar vein to Hobday (1995a), this research enriches the narrow approach of the upgrading literature to learning (based on learning-by-exporting and doing) by employing a wider, evolutionary approach encompassing various other learning mechanisms that do not rest only on experience in production and trade but also on consumption and search as sources of knowledge. The mechanisms that allow learning in networks are derived from what the learning literature classifies as ‘learning external and internal to the firm’ (as explained in detail in sub-section 2.3.2.2). Hence, this research adopts the taxonomy of learning developed by Malerba (1992) with elaborations made by von Tunzelmann and Wang (2007) (Table 2.2).⁵⁶

3.4.1 Learning mechanisms external to the firm

The categories and definitions of learning mechanisms external to the firm as used in this research are summarised in Table 2.2 above. Here, each learning mechanism is briefly reviewed with respect to the literature it is drawn from and how it is related to this research.

a. Learning from knowledge spillovers is learning from the production activities of competitors and other horizontally-related firms/organisations in the industry.⁵⁷ The work of Griliches (1979, 1992) drew attention to the effect of R&D spillovers on the total factor productivity growth of industries, and “outlined the problems related to the empirical measurement of spillovers” (Rojec and Knell 2012: 1). He broadly defines spillovers as flows of ideas between agents at less than the original cost that increase in relation to the technological and geographical closeness of these agents (Griliches 1979, 1992).⁵⁸

As pointed out in endogenous growth theory, knowledge is a public good that can diffuse from its creators to other agents in the economy (Grossman and Helpman 1991, Caves 1999), and so the best ways to access missing knowledge from alternative

⁵⁶ Analytically I prefer this taxonomy to the one developed by Jensen *et al.*’s (2007) in which there are two learning modes based on the production and use of codified scientific and technical knowledge, the Science, Technology and Innovation (STI) mode, and on experienced, the Doing, Using and Interacting (DUI) mode. This taxonomy allows us to capture spillover effects as well as training in addition to these two learning modes.

⁵⁷ It is hard to capture spillover effects from competitors if the firm and the competitor are not in a relationship. In my fieldwork, although *market* spillovers from competitors are observed, they are not reflected in the dataset. Only the spillover effects that took place within a relationship are included.

⁵⁸ Cohen and Levinthal (1989: 571) also define spillovers as “any original, valuable knowledge generated in the research process which becomes publicly accessible, whether it be knowledge fully characterising an innovation, or knowledge of a more intermediate sort”.

sources, as well as the consequences of having access to it and absorbing it, are manifold and different for every firm. Spillovers are most often unintended knowledge and information externalities and public sources, and are difficult to measure, which leads researchers “to rely on more or less crude proxy variables” (Kaiser 2002: 127; see also Cassiman and Veugelers 2002, Bönte and Keilbach 2005).

The channels of spillovers on which there is a consensus in the literature are the demonstration, observation, imitation and application of processes, advanced technologies, product designs, management practices, and so on, as well as mobility of trained labour and management personnel, which allows the transfer of tacit knowledge (Mowery and Oxley 1995, World Investment Report 2001, Günther 2005, Saliola and Zanfei 2009). From the technology transfer (TT) point of view, Mowery and Oxley (1995) also identify the linkages between foreign-owned firms and domestic suppliers (as well as competitive pressure and mobile human capital) as a spillover channel. Günther (2005) calls this spillovers through cooperation, noting that it occurs either as supplier or customer support or in other forms of cooperation; for instance, when a foreign firm is interested in enabling a domestic firm to produce certain products according to the quality requirements of the foreign firm and to become a reliable future supplier (this is very commonly observed in GVCs). Spillovers through cooperation covers informal relations such as personal relationships between employees of the partner organisations, training by technical people sent by the partner, and formal relationships such as firm visits and arranged training in specialised business areas. The shortcomings of the domestic firms that lead them to seek help from spillovers are lack of interpersonal relationships, skills, knowledge, and managerial capability (Caves 1999).

Therefore, this research draws on the spillover literature that focuses on *incoming spillovers from cooperation partners*, i.e. knowledge coming at little or no cost through relationships of the firms with other organisations. It focuses on the spillovers *at the network level*, and aims at filling a gap by making use of ‘firm-level insights’ to understand what is going on during the networking activities of the firm with other organisations with regard to *knowledge* spillovers (not restricted to technology, but in any area relevant to the needs of the domestic firm, and not restricted to FDI, but from any kind of foreign or domestic partners) (Günter 2005).

One of the sources of knowledge spillovers during relationships can be firms that are operating in a similar industrial specialisation, but not necessarily competitors, such as global buyers who are brand manufacturers with production capabilities. Another source can be firms that are horizontally linked to the domestic firm, such as technology suppliers. Here, technology acquisition may turn into knowledge spillovers: Mowery and Oxley (1995: 78-79) argue that “technological benefits [from inward technology transfer] generally assume the form of spillovers”, whose sources are ‘reverse engineering’, which may result in the development of similar products, and skill acquisition through ‘learning by using’ within the firm. Universities and research institutes come under the heading of academic spillovers, and they spill over knowledge through personal contacts between academics and firm employees as much as formal research collaboration between university and industry (Audretsch *et al.* 2004).

Empirical studies on the quantitative analysis of incoming spillovers through cooperation find complementary results. Fritsch and Franke (2004) in general find that R&D cooperation is only of relatively minor importance as a medium for knowledge spillovers. Distinguishing between vertical and horizontal R&D cooperation, Cassiman and Veugelers (2002) find that the presence of spillovers has a positive effect on the probability of R&D cooperation with universities and research institutes, while having no effect on that with customers and suppliers. Distinguishing between formal and informal cooperation with customer and suppliers, Bönte and Keilbach (2005) find only weak evidence for a positive effect of incoming spillovers from formal cooperation with customers only. In automotive GVCs, Gentile-Lüdecke and Giroud (2009) find that Polish suppliers enhance their business capabilities through positive incoming spillovers from MNC customers. Based on her qualitative work on incoming spillovers in Hungary, Günther (2005) also finds that “demonstration effects [imitation] were mostly important in the early stage of transition” (p.16) and are “more likely to occur in the context of business relations between foreign and domestic firms” (p.10).

There is a large spillover literature, which mainly focuses on the spillover effects of FDI on developing country firms, that is beyond the scope of this research. For the purposes of this research, the only such partners included in the analysis are foreign strategic investors (with less than 50% shares) and MNC subsidiaries. The expected channels for

spillover from these partners include the training of employees in the domestic firms working upstream or downstream in their value chain / production network and the effect of competitive pressure that spurs domestic firms to imitate the ways they deal with capacity augmentation, productivity improvements, marketing strategies, distribution channel developments, and so on (Radošević 1999a).⁵⁹

b. Learning by advances in S&T and education is about absorbing new developments in S&T, particularly in close cooperation with suppliers of technology and skills (sourced from formal 'search'/supply). A variety of significant sources of new advances in S&T manifests itself in university-industry links in the form of education and joint research, in contract research for research and product development sourced to public and private R&D institutes, in hiring consultancy services and/or skilled people (from the university or research institutes), in technology suppliers for technology acquisition and transfer, technical meetings with any of these partners, and participation in trade shows (Mowery and Oxley 1995, Veugelers and Cassiman 1999, Daim and Kocaoglu 2008). In this sense, learning by advances in S&T seems to be rooted in technology sourcing networks more than other learning mechanisms external to the firm.

Mowery and Oxley (1995) argue that technology transfer, whether international and domestic, "is a costly, time-intensive, and knowledge-intensive process", and that technology transfers that relied on 'arm's length' relations such as licensing of relatively mature technologies, turnkey plants and capital goods imports - "have been particularly important in the early stages of the 'latecomer' pattern of industrialisation". In contrast, little emphasis has been given to R&D investment, public policies, demand by domestic entrepreneurs for public R&D funding and other formal technology programs at these early stages (Mowery and Oxley 1995: 69, 79, 81; Contractor and Sagafi-Nejad 1981).

This research takes account of the possibility that technology purchases might become an important networking activity for learning and upgrading; mainly because lately 'package' technology purchases provide installation and training (and after sale services

⁵⁹ As McDermott and Corredoira (2010:308) state, "over the past 20 years, research on the spillover benefits from foreign direct investment (FDI) has increasingly coincided with work on the sources of upgrading for domestic firms in developing countries".

within the warranty period), which have introduced a different dimension to technology acquisition projects (Contractor 1998). Contractor and Sagafi-Nejad (1981) single out three lines of analysis from the literature. First, the type of technology transferred, the commitment of the supplier firm, and the duration of the arrangement are a function of the mode of association of these supplier and user enterprises, which ranges from purely AL agreements to equity affiliations and influences the form and content of the transfer packages. Second, the effectiveness of a transfer depends, *ceteris paribus*, on the absorptive capacity of the recipient firm and the level of technological development of the host country. Third, technology 'package' purchases vary with the industry type, abilities of the recipient firm and the life cycle stage of the technology. Hence, the less technologically advanced the recipient firm, the greater the need for a complete technology 'package'.

By examining the effect of external technology acquisition on firm performance, Tsai and Wang (2008) found that this acquisition does not provide a significant contribution to firm performance per se; however, the positive impact of external technology acquisition on firm performance increases with the level of internal R&D efforts in large Taiwanese electronics firms. Their result indicates that when interpreting the effects of learning from advances in S&T on firm-level upgrading, I have to pay attention to the internal factors complementary to the external learning mechanisms. In a similar vein, in their work on Argentine manufacturing firms during 1992-2001 period, Chudnovsky *et al.* (2006) found that technology acquisition in combination with in-house R&D expenditures have positive payoffs in terms of enhanced probability of introducing new products and/or processes to the market.

c. Learning by interacting A concept developed by Lundvall (1988 and 1992c) in his work on national innovation systems, learning by interacting refers to frequent talk and/or close work between individuals or groups within the firm in question and upstream suppliers or downstream customers, users, and with other firms/organisations in the industry. The upgrading literature provides evidence of value chains and production networks as an avenue for learning by interacting with foreign partners, mainly customers but sometimes suppliers, who serve as important sources of knowledge for emerging market firms (Bell and Albu 1999, Pellegrin 2001, Schmitz 2004), as well as concerning users as sources of information for innovation (von Hippel

1988). Hence, an association between learning by interacting and production networks is more expected than with other learning mechanisms external to the firm.

d. No learning during the relationship Having access to an external source does not necessarily mean the firm is capable of recognizing new, valuable knowledge. During the interviews, this kind of observation - the case of 'no learning took place' - emerged. Assuming the firm was conscious of what it is learning in its relationships, no learning taking place meant the firm was also aware that there was no new valuable knowledge to be withdrawn for the firm during the relationship.⁶⁰ When the firm recognised the potentially useful knowledge and acquired it whilst in a relationship, then it meant the firm had learned. Therefore, this category of learning mechanisms is expected to associate with no upgrading category of the upgrading types. This category is also expected to be useful in econometric analysis as a reference category so as to understand the significance of the first three categories in comparison with no learning in a relationship.

3.4.2 Learning mechanisms internal to the firm

Drawing on the learning taxonomy of Malerba (1992) with elaborations made by von Tunzelmann and Wang (2007) (Table 2.2), the learning mechanisms internal to the firm are also categorised according to the relevant sources of knowledge:

1. Learning mechanisms associated with *production* activities include:

Learning by doing Learning generated by improving the existing knowledge base, experience and skills in *production* through the absorption of the new knowledge acquired in a cumulative way by the own efforts of the firm without any external interference in the process.

Learning by imitating Learning generated by trying to imitate the existing processes or products of customers or competitors by the own efforts of the firm. Imitation facilitates catching-up through internalisation of technological knowledge, as in the case of Korea and Taiwan when compared to turn-key technology acquisition projects and FDI in Latin America (Von Tunzelmann 1995).

⁶⁰ Naturally, it would not have been easy to gather information from the interviewees about learning that they were not aware of. However, what the interviewees were not expected to be aware of was the particular mechanism of learning that took place according to Malerba's (1992) taxonomy.

Learning by failing Learning by failing refers to learning from mistakes such as failing in entrepreneurial and marketing attempts and experiencing managerial barriers, and trying not to repeat them, or learning from failing to meet the requirements of customers, partners, etc. and from their feedback showing the deficiencies in terms of technology, quality or competence. In my fieldwork, I came across learning by failing in cooperating with other agents, mostly with customers and suppliers, occasionally with complementary producers. The impact of learning from a failed relationship has always been accommodated internally.

2. Learning mechanisms associated with *consumption* activities include:

Learning by using Learning generated as a result of the subsequent use of a new *technology or knowledge* acquired externally. For technology acquisition, normally payment is made, whereas knowledge acquisition may well be a part of spillover. Even if the technology acquisition is assisted / accompanied by the technical engineers of the technology supplier firm, the acquirer firms do not easily digest the new knowledge transferred through packaged technology. The only feasible way for the firms to understand and apply the new knowledge is through learning-by-using (Powell and Grodal, 2005). It particularly allows firms to make minor additions and modifications in the design of the end product of the firm, technical components of the new technology, and so on.

Learning by monitoring Learning generated through paying particular attention to what customers and suppliers (vertical effects, Sabel 1994) and competitors and other firms (horizontal effects - Malerba 1992) are doing in the industry.

3. Learning mechanisms associated with *search 'supply'* activities include:

Learning by training and research Learning by research (Kim 1998a) and learning by training (von Tunzelmann and Wang 2007) generated within the firm following an externally acquired knowledge. In the emerging market context, in the early years of transition, these internal learning mechanisms are expected to be stimulated and guided by external sources of knowledge, such as networks, and over the years the firm more consciously generates these activities on its own. Thus, learning by training and research represents the improved awareness of the firm to combine the externally

acquired knowledge with its own internal resources.⁶¹ In this way, in a dynamic analysis of firm-level upgrading, the firm presents a continuum of learning by training and research from being a passive learner to being an active searcher / learner. Therefore, learning by training and research becomes the category of internal learning mechanisms that represents absorptive capacity the most. In a time scale, it even helps us to understand the development of level of absorptive capacity of the firm. However, it is acknowledged that this is a very crude approach to absorptive capacity within the scope of learning in networks, and hence, this research by no means claims to analyse the absorptive capacity of the firm.

In the particular context of emerging-market firms in LMT industries, these learning mechanisms allow learning through effective use, reconfiguration, and/or creation of the resources (both capital and human) and capabilities (both organisational and technological) of the firm. This is because, in most firms visited, instead of an in-house R&D unit, different kinds of internal resources within the firm have been compensated for these tasks (partly due to the nature of the industries studied here). Examples can be found in the active effort of production engineers to use externally acquired knowledge and technology in order to improve specific technologies and to experiment on specific tasks or to improve practices within the firm based on trial and error, as well as the joint efforts of production engineers and the marketing department to gain insight for new product development by means of adapting and improving existing technologies in use.

Developments of human resources is still a new area for transition country firms, which are learning how to accomplish this through internal formal and informal training of the employees as well as hiring specialised people in the knowledge area sought. This leads in turn to improvements in the capabilities of the firm, including learning capabilities. An example can be found in the move to buy fabrics for OEM production, a completely new capability development for Polish clothing firms in the 1990s, which had previously relied on global buyers to provide fabrics and only provided sewing services. This move made progress possible in their own product development, by increasing the quality of their product in the domestic market; in other words, it led to achievement of quality upgrading in resources coupled with functional upgrading. This can also be

⁶¹ As Penrose (1959) stressed (see section 3.3.3), using own resources is related to managerial ability.

exemplified by the upgrading of the skills of managers and employees, improvements in communication within the organisation, and by demonstrating an ability to implement what was learnt (e.g. becoming OBM in the domestic market while continuing OEM production for the export markets - see Yoruk 2004 or establishing a wholly-owned subsidiary in marketing, distribution, and so on) and thereby staying one step ahead of the competitors.

No learning within the firm “[L]earning does not always lead to intelligent behaviour” (Levitt and March 1988: 335). There are cases where there is no learning during the relationship or no capacity to internalise the externally acquired knowledge within the firm to yield a sound outcome for firm-level upgrading.

In summary, the effective use of learning by doing/imitating/ failing and learning by using/monitoring within the firm are passive approaches to internalisation of external knowledge while that of learning by training and research is a more active approach. The latter type of learning is therefore more representative of a developing absorptive capacity within the emerging market firm.

3.5 FIRM STRATEGIES

This section briefly examines the theoretical background for firm strategies for access and optimal use of the external knowledge; first as they take place in the upgrading literature and then try to fill the gap observed in the upgrading literature from the competence-building perspective.

One of the driving forces behind firm-level upgrading in the literature is the ultimate target to enhance firm competitiveness. As noted above, some definitions of upgrading even suggest focusing on improving the competitive position of firms compared to their competitors (Kaplinsky and Readman 2001; Meyer-Stamer 2004; Schmitz 1999, 2003).⁶² In fact, the varying extent of firm competitiveness in GVCs/GPNs is a result of differences in firm’s capabilities to upgrade, which are not independent of improvements in other competences of the firm (Giuliani *et al.* 2005). Hence, the GVC

⁶² “In the future we need to rethink the concept of upgrading, and acknowledge that it must be a relational category that does not compare a company’s, cluster’s or location’s previous practice with current practice, but looks at their position vis-à-vis main competitors instead.” (Meyer-Stamer 2004: 330). “...[U]pgrading means learning within local markets or elsewhere to improve competitiveness in order to be noticed by value chain scouts.” (Meyer-Stamer 2004:338).

perspective on functional upgrading extends the focus beyond the improvement of capabilities in production to such areas as “design and marketing skills, diversifying customers and market destinations, developing the capacity to introduce new products or to imitate leading innovators quickly” (Schmitz 2003: 285). This generally applies to firms that operate in multiple chains and that “leverage competences across these chains”. These firms pursue different upgrading strategies (not necessarily a linear one like OEM-ODM-OBM), which eventually leads to a growth strategy based on the synergies between different chain activities in different markets (Lee and Chen 2000, Kishimoto 2004, Schmitz 2006, Navas-Aleman 2011). These authors therefore stress the need for paying more attention to different firm strategies (within the context of GVCs/GPNs).

As discussed in Chapter 2, however, one of the major drawbacks of GVCs is that the lead firms tend to leave the suppliers when the latter develop higher competences, mostly due to increasing labour costs. These supplier firms with higher competences are able to focus on enhancing their competitiveness through, for instance, ODM production for export markets or OBM production for domestic markets in combinations with their OEM production for export markets, though most often in the form of imitation of the foreign buyer. Such a firm becomes a ‘network organiser’ in its domestic environment / market (see Yoruk 2002a). This in turn requires continuous improvement of competences to sustain the competitiveness of the firm. The GVC approach to firm strategies, like Porter’s ‘competitive strategy’⁶³, focuses strongly on product-market positioning as a significant aspect of global competitiveness, but fails to provide insight into the process of knowledge acquisition and competence building (Hamel 1991) before product-market positioning. The focus of firm strategies needs to be expanded from competition to competence-building within and beyond the GVCs.

Teece, Pisano and Shuen (1994, 1997) emphasise the importance of strategy development for the effective coordination and redeployment of internal and external

⁶³ One commonly accepted structuring of firm strategies is Porter’s (1990) ‘competitive strategy’ with its five forces framework (suppliers, buyers, substitutes, potential entrants and industrial competitors). Porter (1990) argues that there are three generic strategies for firms to achieve competitive advantage in their industries: *cost advantage*, by becoming low cost producers; *differentiation*, by being unique with respect to one or more dimensions that are widely valued by the consumers; and *focus*, by defining narrow segments within the industry in which the firm is willing to compete. The third strategy can be pursued as cost focus or differentiation focus. Failure of the firm to locate itself in one of these strategies is described as being *stuck in the middle* by Porter (Connor and Shiek, 1997).

organisational skills, resources and functional competencies in a constantly changing business environment. Both routinised behaviour (varying according to the firm's existing knowledge base) and differences in interpretations of economic opportunities and constraints and in the specialisations of firms (at different levels of the value chain) seem to account for the variation in the firm's responses to their environment through the strategies they develop and implement (Nelson and Winter 1982). In this regard, one of the sources of competitive advantage comes from the management's ability to consolidate a firm's technology and production skills into competences in order to adapt quickly to changing opportunities in the market (Prahalad and Hamel 1990).

The competence-based organisational model of firm strategies developed by Palpacuer (2000) highlights the importance of managing competences as a response of the firms to new competitive pressures in their markets, not only in relation to intra-firm activity but also to inter-firm cooperation (she particularly looks at GPNs). Hamel (1991) analyses the relationship between firms' learning in international alliances and their strategies by comparing 'firms with internalisation intent' with 'firms without clear corporate goals for competence building'. He concludes that the former view learning (i.e. the acquisition of knowledge and skills from the partner) as critical to the growth of the entire company, and not just the competitiveness of a single product or business, while the latter are unlikely to understand the critical contribution of core competence leadership to long term competitiveness and therefore to devote resources to the task of learning. Firm strategies shaped by competitive forces and firm competences are therefore an underlying inducement behind firm-level upgrading (cf. Madhok 2000).

This research argues that a strategy based on an intentional learning process which aims at utilisation of both the knowledge base of the firm and the knowledge acquired through external linkages will have a significant impact on firm-level upgrading. This learning-focused strategy is *competence building-oriented* and constitutes the 'roots of competitiveness', the source of new products / processes and the foundation for long-term strategy (Prahalad and Hamel 1990).⁶⁴ The primary concern of such a strategy is

⁶⁴ Drawing on von Tunzelmann and Wang (2007), this research focuses on 'competencies' which "represent enhancements to productive resources of a particular organization that are developed outside the organisation and then 'hired in' or otherwise acquired by that organization" (von Tunzelmann 2010: 12) (e.g. hiring graduates whose actual enhancements are carried out in the universities). Carlsson and Eliasson (1991) define *competence* as 'the ability to identify, expand and exploit business opportunities'

to achieve the uniqueness of a firm's portfolio of resources and competences by exploiting differences from other firms through a continuum of levels of learning from low to high (e.g., Fiol and Lyles 1985; Dodgson 1990). Low-level/tactical learning is more short-term, focused and context-specific (e.g. solving immediate problems) than high-level/strategic learning (e.g. developing managerial and scientific/technological skills and competencies which provide the basis for future advance).

3.5.1 Competence-oriented firm strategy

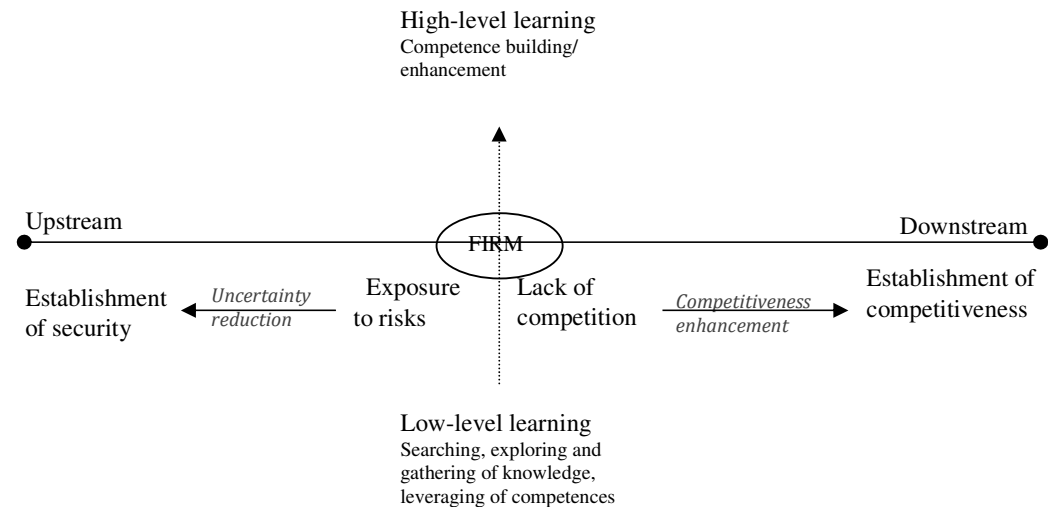
A competence-oriented firm strategy presents a continuum of efforts from simple search, exploration and gathering of knowledge to more sophisticated competence-building or enhancement. A firm strategy based on competence-building allows a better coordination of external learning with internal learning (e.g. developing managerial and scientific/technological skills and competencies that provide the basis for future advance), while a firm strategy based on searching, exploring and gathering of knowledge from partners who are functionally specialised in the production of that knowledge (e.g., universities, research institutes) may focus on solving immediate problems.

Competence-building “occurs when firms acquire or develop and learn how to use new and qualitatively different resources, capabilities and ways of coordinating” them for upgrading different firm functions (Sanchez and Heene 2004: 39). In the emerging market context, a competence-building strategy represents an intention to exploit the available learning opportunities in each relationship the firm is involved in incrementally for firm-level upgrading, while searching, exploring and gathering of knowledge represents a survival technique (Lundvall 1992b). Searching and exploring leads to competence leveraging “when a firm brings product offers to markets in ways that do not involve qualitative changes in the resources, capabilities or modes of coordination used by the firm” (Sanchez and Heene 2004: 39). This is observed in firms

(quoted in Carlsson 1994: 15). Competencies are related to the functions of the firm, i.e. production, marketing, technology, and so on and are built. For instance, Miyazaki (1995) defines a firm's ability to integrate different streams of production processes as ‘production competence’; a firm's ability to integrate marketing portfolio elements such as building a brand image and creating channels to get information on consumer demand as ‘marketing competence’; a firm's ability to mobilise organisation, combining people of different skills to work effectively together as ‘organisational competence’, and its capacity to generate change in response to technological opportunities and to assimilate them into its core capabilities as ‘technological competence’.

operating in multiple value chains and production networks. Both industries chosen in this research require competence enhancement in both technological issues and business matters to keep up with the competition in their markets. For this reason, marketing and technology go hand in hand in the analysis of firm strategic orientation towards networks.

Figure 3.2 Characteristics of competition- and competence-oriented firm strategies



Source: Author

There are also market-focused strategies that target increasing business volume, market share, making profits, monitoring their competitors and managing uncertainties in their environment in order to establish competitiveness in product markets and security in supply markets. They are *competition-oriented*, with priority given to volatile customer needs and preferences, and are rather short-termist, with lack of stability and direction for a long-term strategy. The primary concern for such a strategy is to achieve competitive positioning among other firms, most often by doing the same thing as other firms in the market. For instance, the results of the business enterprise environment and performance survey run by the European Bank for Reconstruction and Development (EBRD) in 20 CEECs show that firms facing one-to-three competitors in their main product market tend to “develop new products, replace managers, or change their organisational structure if they are subject to a hard budget constraint, with their moderate degree of market power providing the reward necessary to innovate” (World Bank 2002: 57).

3.5.2 Competition-oriented firm strategy

A competition-oriented firm strategy targets establishment of competitiveness downstream in end markets and of security upstream in supply markets. Firms pursuing competition-oriented strategy mainly give priority to monitoring their external environment and specifying their needs for quick adaptation in order to improve their competitiveness, and to securing their market by the help of the relationships they establish. These strategies can be product/market strategies, such as going up-market and entering market niches, entering distribution networks and integrating upwards, undertaking active marketing and brand strategies, and making a long-term logistics arrangement with the distribution sector (Godinho 1993, Schmitz 2004). Managing quantity risk and input quality are extensions of brand strategies. Manufacturing products with better quality than competitors is the basis of upgrading that leads to increased market share and higher profits. Both industries selected in this research are strategically biased towards responding to these market developments, because firms in these industries sell labels, not the garments or food.

Firms also seek to reduce uncertainty that occurs as a result of the turbulence in markets and technology by the help of the relationships they establish, but they are able to reduce it only to a certain degree (Smidt and Wever, 1990). In Poland during transition, uncertainty was a big part of the business life. “Pfeffer and Nowak (1976) concluded that linkages are used to reduce uncertainty when oligopolistic rivalry is difficult to stabilize” (Nohria and Garcia-Pont, 1991: 107), which applies to the Polish food-processing industry.

As a result, firm strategies can be plotted on a spectrum of competition- and competence-orientation (Figure 3.2). These orientations emerge from the need of the firm to know what is possible now (which depends on its competitive position) and what is desirable in the near future (which depends on its long-term goals) (Smidt and Wever 1990). Networks as sources of knowledge are expected to have a significant bearing on the firm’s competence-building through learning, first and foremost to cope with Schumpeterian dynamic competition, which “is not a question of fluctuating prices but of ever-changing products, market-structures, technologies, resources, forms of industrial organisation and so forth” (von Tunzelmann and Wang 2007: 202). A firm

strategy pursuing competence-building therefore would significantly contribute to the upgrading of the firm.

3.6 CONCLUSION

This chapter has proposed an analytical framework for the analysis of networks and firm-level upgrading using learning in networks as a bridging concept. The proposed analytical framework has built on the theoretical framework explained in the previous chapter, and aimed at overcoming the narrow approach of the upgrading literature to the key concepts this framework uses, namely 'networks' and 'learning'. To do so, it has embraced an evolutionary approach to firm-level upgrading, first by distinguishing types of networks based on the distinction between 'production systems' and 'knowledge systems' as developed by Bell and Albu (1999) and second by incorporating learning mechanisms external and internal to the firm into the upgrading literature. It has defined learning in networks as a two-stage process whereby the role of the interaction between inter-and intra-organisational knowledge transfer in firm-level upgrading is emphasised. The details of the processes between these key concepts of this framework and the methodological approach to the analysis are presented in the next chapter.

Chapter 4 RESEARCH METHODOLOGY

4.1. INTRODUCTION

This chapter describes the research methodology in relation to the analytical framework developed in Chapter 3. First, the research questions are re-visited, the research model is explained and boundaries and limitations of this research are discussed. Second, the research design is introduced in order to clarify how the analysis will be made, and the discussion of the sources of information explains the data acquisition process step-by-step. Third, the method by which the elements of a dynamic analysis are derived from the recent history of Poland's economic development is explained. Fourth, the variables that are utilised in the analyses based on the analytical framework and the research model are introduced. Finally, the empirical data analysis methods that will be used in the three analysis chapters are discussed.

4.2 THE RESEARCH QUESTION AND THE RESEARCH MODEL

4.2.1 The research questions

The upgrading literature to date has given partial answers to the questions of why there is a need to upgrade, through what channels upgrading is possible (i.e. value chains), and what is upgraded, but has mainly overlooked the issue of 'how' upgrading at the firm level happens. This requires a deeper understanding of the relationships, knowledge transfer and learning mechanisms in these relationships, the partners involved, and so on, with a new empirical approach that tests the findings of the case studies that have been produced so far.

Acknowledging the view that emerging market firms need external knowledge to upgrade and can best access to it through networks (i.e. not through market or hierarchic relations exclusively, as discussed in section 3.2.1), this thesis aims at extending our understanding of the relationship between involving in networks and firm-level upgrading through examining the research question: *How does involvement in networks bring about firm-level upgrading?*

This research question is broken down into the following sub-questions so as to look in detail at the processes required for firm-level upgrading: *How does learning take place externally through networks? In other words, what characteristics of networks affect*

‘learning external to the firm’? And how does learning in networks contribute to firm-level upgrading?

Complementary to the analysis of learning in networks as a source of firm-level upgrading, this research also looks at the influence of the firm strategies that are developed within a specific orientation as a result of the relationships of the firm and tries to answer the sub-question of: *How does the firm’s strategic orientation affect firm-level upgrading?*

As a result, the key concepts in these questions are firm-level upgrading, networks and learning in networks. All of these concepts were constructed within a systematic analytical framework, as detailed in section 3.2. To implement this framework empirically, this research will put each relationship of the firm within different network types under the microscope.

4.2.2 The Research Model

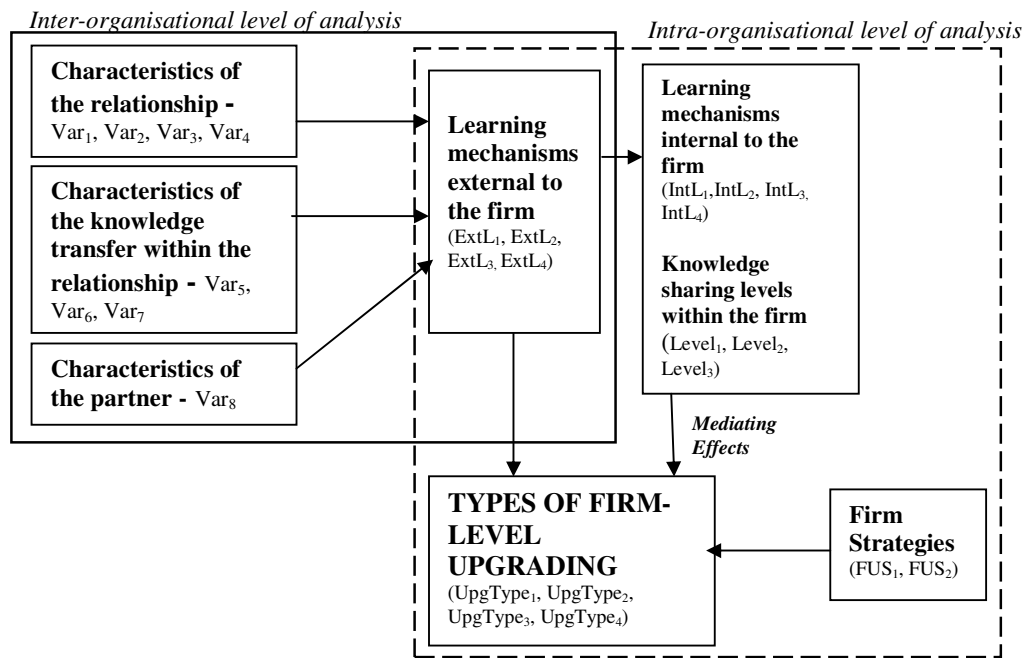
The research model used to analyse the main research question is illustrated in Figure 4.1. The main assumption behind this model is that firms with cooperative strategies are involved in networks that transfer knowledge.⁶⁵ Figure 4.1 represents an idealised version of how networks play a role in firm-level upgrading. This research model suggests two levels of analysis - inter-organisational and intra-organisational - in accordance with the definition of ‘learning in networks’ (section 3.4). The former refers to learning mechanisms in relationships of various network types, both among firms and between firms and other organisations. It is mostly a matter knowledge transfer between partners in a relationship through inter-personal interaction. In addition to the characteristics of knowledge transfer within the relationship, the characteristics of the relationship and the partner are expected to have an effect on learning mechanisms external to the firm. The latter refers to the internalisation of what is learnt externally. It is mostly a matter of knowledge sharing between the knowledge-acquiring individuals and other employees within and between units in the organisation of the firm.

As the research model shows, this research’s analytical approach to the learning mechanisms in networks is centred on the learning mechanisms external to the firm first

⁶⁵ See the analytical framework (Figure 3.1).

attempting to determine the effects of network characteristics on learning mechanisms external to the firm (as the dependent variable) and second the effects of learning mechanisms external to the firm (now appearing as an independent variable) on firm-level upgrading.

Figure 4.1 The research model that links the key concepts of this research in two-level analysis



Source: Author

4.2.3 Boundaries and limitations of this research

Since real life situations are more complex, there are always some other factors that are not displayed in our research model, such as meso (industry-level) and macro (country-level) factors. A micro-level analysis of networks in a dynamic context creates the boundaries of the methodology of this research. In order to achieve a comprehensive understanding of the relationship between the concepts of this study, that is firm-level upgrading and networks, this research was conducted at the firm level instead of the industry level, but it will place firms in the context of the meso environment of the 'industry' or 'sub-sector' that surrounds them, not least because this is a key determinant of their strategy (cf. Porter, 1990). Therefore, it is indeed an amalgamation of micro- and meso-level analyses since it examines the interaction between firms at the industry level as well as between firms and other organisations.

By choosing to focus down to the micro-level analysis of networks, this research pays little attention to other factors that may influence the firm-level upgrading such as the role of state (e.g. through government policies, national education and training system), historical experience, cultural effects, and so on. Among macro factors, only the S&T system in Poland was reviewed in order to understand the context in which the research was undertaken, and the analysis included elements of the S&T system relevant to the micro level, such as the firm's networks with universities and research institutes.

With regard to strategic orientation, this research examines the impact of firm-specific resources and capabilities (competence-building) as well as the global impacts of competition on the industry (competitiveness enhancement) on strategy development for upgrading. There is a third leg in strategy discussed in the literature on emerging markets, which are institutional conditions and transitions at the macro level (Peng *et al.* 2008). As noted above, this aspect is discussed with regard to S&T systems (in Chapter 5), but was not included in the analysis on strategy in this research to keep the level of analysis at micro and meso-level.

Similarly, avoiding other internal factors that may influence firm-level upgrading is another limitation of this analysis. This is due to the lack of variables that unpack the evolution of firms' capabilities and competences for firm-level upgrading, which is possible only when the unit of analysis is the firm itself rather than the relationships of the firm. However, there are more firm-level studies that investigate capability development through learning (Figueiredo 2003, Ariffin and Figueiredo 2004, Dutrenit 2000, Dantas and Bell 2009) than network-based studies, which are mostly in the area of learning in strategic alliances and none of which deals with firm-level upgrading. Among internal factors, only the impact of firm strategy on types of firm-level upgrading is employed, in the form of targeted gains of the firm from a particular relationship (e.g. whether to increase competitiveness of the firm as a result of the relationship or enhance a particular competence within the firm), i.e. in relation to networks (Figure 4.1).

Last but not least, this research is merely interested in the networks that transfer knowledge and thereby contribute to the upgrading of the firm's functions. It does not

aim to measure the upgrading within firm, as this would require the aforementioned type of variables about firm-level upgrading that are not available for use in this analysis. The upgrading literature is also not primarily concerned with the measurement of upgrading, as mentioned earlier in section 2.2.2.2. Instead this research tries to advance our understanding of network-related sources of upgrading within the firm (i.e. specific network characteristics, learning mechanisms in networks, firm strategies). Additionally, analysing both questions would be too much for one dissertation.

4.3 RESEARCH DESIGN

The research of this thesis was designed in a way to inter-relate the key concepts of the research question and to provide essential insights into the mechanisms by which firm-level upgrading occurs. This section will explain the research design in detail. The first section describes the sampling strategy, underlining the rationale for the choices made during sampling. The second section introduces the sample of firms created on the basis of this sampling strategy and discusses its representativeness. The third section discusses the primary and secondary data collection methods used. The next section explains how the dataset of relationships is created from the in-depth interviews, and the final section explains the unit of analysis and its relevance to the research questions investigated in this thesis.

4.3.1 Sampling strategy

A sample of firms has been created in order to make a precise estimate of how accurately the sample results are likely to correspond to those from the total population of firms with more than 500 employees. The underlying reasons for the choice of large firms as the total population are explained in section 4.3.1.3 below.

The sampling strategy of this research consists of three stages (Table 4.1). In the first stage, two contrasting LMT industries and a CEE country to be studied were chosen. Again, the underlying reasons for the choice of country and industries are explained in detail in sections 4.3.1.1 and 4.3.1.2 below. As will be explained in more detail in section 4.3.1.3, in the second stage, the focus was narrowed down to large firms (i.e. firms with more than 500 employees) and MNC subsidiaries (even if their number of employees was under 500). At this stage, a pilot questionnaire was conducted to find firms with a reasonably large portfolio of relationships in the form of their own

networks and / or involvement in (established) networks. Finally, in the third stage, as a result of the pilot questionnaire, large *domestically-owned* firms were chosen as the main focus of this research (section 4.3.1.4). This meant eliminating the MNC subsidiaries from this research, as their networking relationships appeared to be dominantly with their headquarters and in the form of hierarchy.

Table 4.1 Sampling strategy of this research

Sampling Stage	Focus Population	Sample Chosen
1.1	Central and Eastern European Countries (CEECs)	Poland
1.2	LMT Industries	Food-processing and Clothing
2	All large firms in Polish food-processing and clothing industries with more than 500 employees	Sample of listed large firms for pilot questionnaire with email, fax, telephone and contact details
3	Sample of firms responded to the pilot questionnaire survey	Domestically owned firms (as a result of the responses to the questionnaire) with more than 500 employees and with a significant portfolio of relationships in the form of their own networks and / or involvement in (established) networks

Source: Author

4.3.1.1 Choice of country

Poland was chosen out of the CEECs, not only because of the importance of these industries in the country's economic indicators but also due to its relatively big size compared to CEECs (see Chapters 1 and 5). Overall, in the context of CEECs, the characterisation of Poland's industrial structure as having a few large domestic firms and low- and medium-technology activities has also been instructive (OECD 2007). So, in the second stage of sampling, large firms were identified as the total population from which this research aimed to generalise.

4.3.1.2 Choice of industries

The food-processing and clothing industries were chosen for this research. The underlying reasons are categorised under similarities and differences. As mentioned in section 1.2.2, the common feature of the industries chosen in this thesis lies in their categorisation among LMT industries. In the OECD classification, both industries are

considered as low-tech, with R&D intensity less than 0.9% (Hatzichronoglou 1997).⁶⁶ The consensus on their low-technology characteristics is based on their strong dependence on external technology acquisition from machinery and equipment suppliers making them supplier-dominated industries, to use Pavitt's (1984) term - rather than in-house R&D for innovation (Heidenreich 2009, Balcerowicz *et al.* 2009). Nevertheless, as section 1.2.2 discussed, food-processing benefits from more scientific and technological opportunities acquired or spilled over from industries to which it is horizontally linked than does the clothing industry. This has a positive effect on innovations in the food-processing industry, helping to shift its technological level from low-tech to medium low-tech.

LMT industries, in general, are by and large overlooked when compared to the abundance of studies on high-tech sectors (Hirsch-Kreinsen 2008, Freddi 2009). Development economists in the upgrading literature work on low-tech industries (such as clothing, footwear, or the low-tech upstream segment of the food-processing industry). There are also empirical studies of the clothing industry from the network point of view, explaining why and how relocation occurs (Smith 2003, Yoruk 2004, Dunford 2004, Pickles *et al.* 2006).⁶⁷ However, studies examining the food-processing industry from networks or value chain perspective are in general limited. A comparison of low-tech industry with a medium-tech industry will be a considerable contribution to the literatures used in this research. Hence, the medium-technology side of the food industry (i.e. food-processing) is chosen over the low-tech side of it (i.e. live animals, raw fruits and vegetables, etc.) while the low-tech, labour-intensive clothing industry is chosen over the textiles industry, which has a relatively higher technology level. In addition, the tobacco sector and leather and footwear sectors are eliminated from the very broadly defined food and clothing industries respectively, due to the need to limit the research to some reasonable sub-sectors. Still, the food-processing industry, on its own, provides a richness of sub-sectors giving an opportunity to present a vast number of types of networking relationships (Table 4.6). At the same time, being integrated into GPNs/GVCs from the beginning, the clothing industry represents these networks at

⁶⁶ The OECD classification is based on conventional accounting of direct and indirect R&D of the industries (Hatzichronoglou 1997).

⁶⁷ Coe *et al.* (2008b) argue that one of the gaps in the GVC/GPN literature is the narrow range of manufacturing industries studied within these frameworks.

different geographical levels (i.e. global, national and local). Hence the boundaries of the industries studied in this research.

Another similarity that derived from being LMT concerns both industries benefiting from the permeation of high technologies, particularly in their ‘non-manufacturing’ activities. The governance structure in the value chain of the food-processing industry has also been changing and evolving towards a shift from producer- to buyer-driven, though it is slower than in the West. The extensive research on apparel chain in the last three decades has shown that the clothing industry in the emerging markets has remained part of buyer-driven GVCs. The Polish clothing industry has provided us with a pattern of upgrading through exporting similar to that of other emerging countries; hence our ability to compare with the previous studies.

Table 4.2 Differences in the characteristics of the chosen industries that allow comparison

<i>Characteristics</i>	Food-processing industry	Clothing industry
<i>Structure of the industry</i>	Consolidation toward oligopolistic structure	Integration into GVCs / GPNs
<i>Technological level (OECD classification)</i>	Low-tech shifting towards medium low-tech	Low-tech
<i>In the recent literature</i>	Associated with knowledge networks, horizontal linkages (von Tunzelmann and Acha 2005, Alfranca, Rama and von Tunzelmann 2004)	Associated with production networks, vertical linkages (Gereffi 1999)
<i>Targeted market and level of competition</i>	Domestic market-oriented (high competition industry within the domestic market)	Export-oriented (high competition industry in the international markets)
<i>Governance structure in GVCs (Gereffi 1994, 1999)</i>	In between producer- and buyer-driven yet largely free from GVCs and its governance structure	Buyer-driven GVCs
<i>Integration to the EU (Kurz and Wittke, 1998)</i>	Through FDI and Polish food-processing industry offering market to the Western manufacturers	Through trade and GPNs/GVCs as a supply base to the Western brand manufacturers
<i>Pavitt sectoral taxonomy (Pavitt 1984)</i>	Supplier-dominated but changing towards demand-driven (von Tunzelmann and Yoruk 2004)	Supplier-dominated

Source: Author

Table 4.2 shows the major differences in the characteristics of the industries chosen. Similar to the trend in international markets, there is a tendency in the Polish food-processing industry towards consolidation (Yoruk 2002c, Blanke-Lawniczak 2009). European food-processing chains experience consolidation also in retailing (Palpacuer

and Tozanli 2008).⁶⁸ This leads the industry to move further toward an oligopolistic structure with little or no room for the local players.⁶⁹ In the clothing industry, the disintegration of production activities has already led to an uneven distribution of the value added within the value chain, and there is a polarisation of producers on the one hand and oligopolistic brand owners, distributors, and retailers on the other, with the latter retaining predominant power within the value chain (Chapter 2).

According to the literature on economic integration of the CEECs with the West, Kurz and Wittke (1998) discuss two paths: trade and FDI integration, where CEE is either a supply base or a market for the Western enterprises. Within this context, at the country level, food-processing firms' integration occurs via FDI, whereas that of clothing firms occurs via trade. At the industry and firm levels, the clothing industry integrates via GPNs as a supply base to the Western brand manufacturers, whereas the food-processing industry offers markets to the Western manufacturers, who increase competition and supply in the domestic market. This is in line with Gereffi's (1999) distinction of sector-specific governance structures (see Appendix A). However, the focus of this research is not on the FDI/MNCs in the food-processing industry (which Gereffi proposes as the leading firms in producer-driven GVCs), but on the domestically-owned food-processing firms.

In the context of economic transition in Poland, some statistical facts about the Polish industries have been instructive for us in choosing the food-processing and clothing industries. In 1989, the food-processing industry played a major role in almost all the CEECs where the percentage of total industrial value added in Polish food-processing (18%) was comparable to that of Czech Republic (12%) and Hungary (17%) (Duponcel 1998). By 1999 only Poland, Romania, and Bulgaria⁷⁰ remained specialised in this industry (Hanzl 2000). Moreover, according to the calculations by the EBRD (1999), in terms of net exports for the 1993-1997 period, in the early to mid-transition years,

⁶⁸ Palpacuer and Tozanli (2008: 87-88) explain it as "large producers specialized in high growth, sophisticated global products that still performed in-house a major part of manufacturing activities and, on the other hand, large retailers developing their own brands for generic products and exercising strong buying power *vis-à-vis* primary food-processing producers".

⁶⁹ The government is most needed against this progress (also see Guardjian *et al.* 2000).

⁷⁰ Hanzl (2000) mentions the 'reagrization' in Romania and Bulgaria took place in the late 1990s due to an employment crisis in industrial production and limited absorption capacity in services. However, she also mentions that a large agricultural sector does not necessarily mean that there is a large and successful food-processing industry.

Poland presents strong revealed comparative advantage in resource-based (wood, oil, gas, coal, etc.) and labour-intensive industries (textiles, clothing, footwear, etc.) and mild disadvantage in agricultural industries (food-processing and live animals, beverages, tobacco, etc.), with declining trends for net exports in the resource-based and agricultural industries and a sharp rise of light industry exports.⁷¹ Statistically, industrial output growth rates of both industries after transformation depict similar patterns of development until 1999, after which the food-processing industry displays recovery while clothing continues to decline.⁷²

This research is focused on the technology and market gaps in the industries studied and seeks, through in-depth interviews, to examine sector-specific features in order to answer the main research question (i.e. the link between learning in networks and upgrading). Such a comparison has not been empirically investigated before in a transition country context, and to our knowledge, not even in other contexts.

Choosing only two industries in the sampling design might create a possible limitation to the analysis. However, because they represent LMT industries as a whole, a pooled sample of data from these two industries is not expected to create a bias in the interpretation of the results for LMT industries. For interpretation of the results with respect to each industry, a dummy variable to represent industries is used in the models.

4.3.1.3 Choice of large firms

The empirical reason for choosing large firms is twofold. The first is related to the emerging market context in which this research is undertaken. In this context, large firms are endowed with relatively better means when compared to small and medium-sized firms (SMEs) and therefore are expected to benefit from wider opportunities to develop networks and learn from networking activities.⁷³ However, the captive type of

⁷¹ This positioning in revealed comparative advantage was the same by 1995 (OECD 1997). In addition, Poland shows revealed comparative *disadvantage* in capital-intensive and skill-based goods, however both with an increasing trend of net exports and often supported by inflows of FDI (EBRD 1999).

⁷² The annual growth of production data provided by the IMF (2000) in the food-processing products and beverages industry (at constant prices) in the 1992-1999 period displays a parallel development with the GDP growth rate in 1992-1998 period, when Poland had the highest growth rates recorded before 2001 deep recession. According to Eurostat data, by 1996 the annual percentage change in both industries' industrial production was as high as 11.7% for wearing apparel and 15.9% for food processing.

⁷³ Some scholars show that large firms, due to their superior organizational resources and scale economies, successfully access different types of networks and exploit knowledge from their environment (Cassiman and Veugelers 2002, Chudnovsky *et al.* 2006). They also present higher innovation rates than

GVCs/GPNs (i.e. lock-in effect) as discussed in the upgrading literature (Chapter 2) had to be overcome in order to get a realistic picture of the impact of these relationships on firm-level upgrading. So, the sample of firms used had to be free of lock-in effects; in other words, had to have other types of relationships. This criterion was more likely to be met by large firms than SMEs during the transition years.⁷⁴ Moreover, most of the former state-owned enterprises in CEECs became major players in these countries' economies through their privatisation, restructuring, and involvement in re-shaping of the industries both at national and global levels (section 5.2.6). Existing work has shown that they have become the key nodes in global production networks and value chains after the transformation (Ozatagan 2010, Kalantaridis *et al.* 2008, Pickles *et al.* 2006, Smith 2003). Initially this was a result of survival reasons (Begg *et al.* 2003), but over the years, as in the Polish case, these firms extended their role to the development of national production networks and value chains (Yoruk 2002, 2004). They owned the major brandnames in these countries, which required rejuvenation in the context of market economy, and were more likely to respond to upgrading opportunities than new start-ups or small workshops which were mostly set-up for taking advantage of the shift of GPNs from Western to Eastern Europe during the transition years.

The second reason is related to the extensive number of firms both in the food-processing and clothing industries due to the predominance of SMEs.⁷⁵ According to the Eurostat database (accessed 2012), in 2005, the total number of food-processing firms in Poland was 16,050, while that of food-processing firms with 250 or more employees was only 262.⁷⁶ Similarly, the number of Polish clothing firms with 250 or more employees in 2005 was 73 out of a total of 19,310 (Eurostat - accessed 2012).^{77,78}

smaller firms in the developed countries (Kogut and Zander 1993, Freeman 1994), and particularly in the food-processing industry (Galizzi and Venturini 1996, Tsekouras 1998).

⁷⁴ Before the actual pilot work, a small scale test of the questionnaire used in the pilot work was done on the Polish SMEs in the clothing industry. The responses by SMEs were in line with this argument.

⁷⁵ The reason for this is the low outlays required to start production in both industries: The SMEs operate with no difficulty alongside the large firms. Moreover, in 1995, the number of food-processing firms functioning in Poland was 24,000, of which only 900 employed more than 900 employees (Duponcel 1998). Blanke-Lawniczak (2009) reports the total number of business entities particularly for the food-processing industry as 16,222 in 1990 which grew to 19,696 in 2004. The number of communist giant enterprises has reduced over the years with privatisation.

⁷⁶ The unpublished data of the Central Statistical Office of Poland in 2003 was in line with the 2005 figures: The total number of food-processing firms was 19,516, while the number of large food-processing firms with more than 250 employees was 270 (Strada *et al.* 2005).

⁷⁷ Again, in 1998, out of 44,000 clothing firms, only 700 clothing firms had more than 50 employees (Kostecka 1998), which further reduced to 621 in 2001 (Kapelko 2006, original source: Polish Federation of Apparel and Textiles).

Therefore, in this sampling stage, a firm database that approximates the total population of registered food-processing and clothing firms operating in Poland with more than 500 employees (hereinafter large firms) was created using the accessible listing of firms registered with Polish Embassy in London.⁷⁹ According to this source, the list of firms with more than 250 employees in 2000 included 243 food-processing (63.5% with 250-499 employees) and 139 clothing firms (66.2% with 250-499 employees). Firms with more than 500 employees amounted to 88 in the food-processing and 47 in the clothing industry (Table C.1 in Appendix C). The number of firms with over 1000 employees appeared to be almost 13% of the large firms in both industries. The number of large firms in this list was quite close to the total population of large firms in both industries because it included all the branded companies in Poland, that had been privatised or were in the process of privatisation, had a lot of publicity and were appearing in all the firm lists available. Finally, the information regarding the ownership of the firms in this list was checked through the list of major foreign investors in Poland by PAIZ (Polish Information and Foreign Investment Agency) in 2000.⁸⁰ It appeared that ten out of 88 food-processing firms and one out of 47 clothing firms had received FDI, leaving 78 food-processing and 46 clothing firms in the list that were domestically owned.

4.3.1.4 Choice of domestically-owned large firms

During sampling strategy, a pilot questionnaire was used where the questions were designed to ask about the ‘quantity’ instead of ‘quality’ of the relationships (see Appendix C.1), because it was crucial to this research to find the firms that were involved in networks.⁸¹ The final sample of firms for interviews was chosen before the

⁷⁸ According to the Eurostat statistics, there has been a 30.2% reduction in the number of food-processing products and beverages firms (excluding the vegetable and animal oils and fats sub-sector) and 22.5% in the number of wearing apparel, dressing, dyeing or fur firms from 2001 to 2007

(http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database - accessed 14 April 2010).

⁷⁹ www.polishemb-trade.co.uk/Home_en/Main_en.htm (accessed in October-November 2000). This source was not a complete register of all firms in these industries in Poland. However, it was the most appropriate available listing of large firms operating in the food-processing and clothing industries at the time. This list provided a wide range of information about each firm (address, year of foundation, ownership, legal status, number of employees, annual turnover, contact details and names and operations coded according to NACE and ISIC). As a starting point, this database was used for the pilot questionnaire survey.

⁸⁰ www.paiz.gov.pl (accessed in October – November 2000)

⁸¹ In other words, it aimed at gauging whether the firm is embedded in some form of networking activities or not rather than to derive conclusions on the extent of knowledge transfer in the respondent firms’ relationships. The details of knowledge transfer and learning in these relationships were naturally left to the in-depth face-to-face interviews.

first fieldwork to Poland on the basis of the responses of the firms to this pilot questionnaire survey, without which it would have been impossible to gather information about the number and the kind of relationships these firms were involved in. It requested respondents to provide information about their firm's operations, activities and networking relations. Information was elicited about the respondent firms' networking activities as well as firms that were going to be more co-operative with our research - an issue due to the language barrier. Email, telephone and fax were used in order to gain access to firms. In order to increase the response rate, the questionnaire was also translated into Polish by a native speaker.⁸² This survey was undertaken in November 2000-January 2001 with some extensions to September 2001. A two-page questionnaire was sent to 124 Polish-owned firms and 16 multinational subsidiaries operating in the Polish food-processing and clothing industries, through e-mail and fax. 28 food-processing and 17 clothing firms were eliminated due to wrong contact details, reducing the total number of Polish owned firms to 79. In three months' time, 21 positive answers (17 from Polish firms, 4 from MNC subsidiaries) and 4 negative answers were collected. On average a response rate of one third was achieved (Table C.2 in Appendix C). Therefore, the pilot questionnaire survey helped to confirm that the sample of firms in this research was created with firms that were involved in networks, in other words, confirming their capability to cooperate – a 'pre-condition' of this research required, in lieu of an 'assumption'.

The distribution and content of the responses to the pilot questionnaires have determined the last stage of the sampling. In terms of the distribution of the responses, there were more responses from food-processing MNC subsidiaries than clothing MNC subsidiaries (nil for the latter)⁸³, and contrastingly there were more responses from Polish-owned clothing firms than food-processing firms. In terms of the content of the responses, there was a clear distinction between the responses of MNC subsidiaries and Polish firms. MNC food-processing subsidiaries that responded to the questionnaire declared that they had either no, or too few, non-market relationships with their external environment. Polish clothing firms declared many subcontracting relationships whereas food-processing firms declared that they had more market relationships than non-market

⁸² Translation into the native language increased the response rate to the questionnaire slightly.

⁸³ There are two foreign investors in the Polish clothing industry who were inaccessible: the German company Ahlers, which produces exclusively for Pierre Cardin, and Levi Strauss. By 2005, this situation has not changed (Terterov and Reuvid 2005).

relationships. It became clear that the incumbent big firms in the CEECs from the socialist era were the dominant organisation type that was experiencing transitional effects when the research was conducted. So, not only was the decision to conduct this research only on large firms confirmed, but also the decision to conduct this research only on Polish-owned firms. In addition, indigenous firms had in general received less attention in the literature (Szymanski *et al.* 2007). However, in CEECs, there is continuity as well as a change: it has to be kept in mind that the past habits, especially at the time of the research, were still influencing the adaptation of large firms.

In addition to the exclusion of MNC subsidiaries operating in Poland, after the first fieldwork, some more firms were excluded from the sample of firms used in this research. One reason was the fierce competition in the domestic market that led some firms to be too secretive and cautious to share their experiences, in the fear that they would incidentally reveal some secrets of the company, jeopardising their competitiveness in their market.⁸⁴ They were the ones that had placed themselves among the top companies in their segment of the industry. An example is a dairy company accepted my visit and interviewing, but once in the interview refused to deliver enough information in the areas this research was interested in, due to secrecy towards their rivals in the market, so that the company had to be excluded due to lack of sufficient information to enter into analysis. Another reason was the change of ownership to foreign investors with big majority of shares. To exemplify, a well-known meat-processing Polish firm was bought by a foreign company shortly before our visit, so this company was not any more in line with the criteria of this research and was excluded. These exclusions led me to get involved in an active search for new firms during the first fieldwork (to be interviewed in the second round of fieldwork) on the basis of information collected from the interviewed firms and the organisations visited, particularly with regard to the big players in each industry / sub-sectors. In some cases their linkages were used; in some cases my individual efforts proved to be useful while I was in Poland, and in some cases the interpreters and their linkages helped to improve the number of firms in the sample (see Table 4.3).⁸⁵

⁸⁴ Because both of the industries are very competitive industries the companies interviewed were given assurance with regard to the company names not to be disclosed in this research.

⁸⁵ For instance, a dairy company and an alcoholic drinks producer company were found through the links of the Prof Andrzej Jasinski in University of Bialystok and a potato processing company was found

Table 4.3 Methods used for creating the sample of the firms used in this research in stages, and the purposes and advantages of these methods

<i>Method</i>	<i>Purposes</i>	<i>Advantages</i>
Stage 1. Creation of firm database through online research	To create the database of the firms which have more than 499 employees in food-processing and clothing industries	Determined the boundaries of the sample for the questionnaire stage
Stage 2. Pilot questionnaires (2 pages questionnaire)	<p>To find out <i>whether or not</i> the firm is involved in networks,</p> <p>To find out in <i>what kind</i> of networking relationships the firm is engaged in,</p> <p>To find out the <i>number</i> of networking relationships the firm has been involved in,</p> <p>To understand which firms are more <i>co-operative</i> with such a study by returning the questionnaire.</p>	<p>To figure out the necessity for interpreters during fieldwork,</p> <p>To understand which firms are more co-operative with such a study by returning the questionnaire,</p> <p>To have an overview of the industries in each country based on micro-level information.</p>
Stage 3. Search of firms during the first fieldwork	To find new firms which are suitable for the criteria of this research in order to improve the number of firms in the sample.	Helped finding new firms that are not only engaged in networking activities but also are cooperative with this research.

Source: Author

4.3.2 The sample of firms

As a result, this research includes a final sample of 16 firms with 8 food-processing and 8 clothing firms in Poland. Given the considerations noted above, there is some basis for concluding that this sample is representative of the total population of larger firms. As stated above, the total number of domestically owned firms with more than 500 employees in food-processing and clothing industries in 2001 was 78 and 46 respectively. The sample represents 10% of the population of large food-processing (8/78) and 17% of the population of large clothing firms (8/46).

The sample also meets the criteria of this research with regard to the networking activities of the chosen firms. With regard to other characteristics of the firms, in both industries, they all are large brand manufacturers at home, with more than 500 employees. In both industries, the firms operate in market niches that they were restricted to in the socialist era and have largely stayed in during the transition years. Some of the food-processing firms function as subcontractors to foreign customers at

through the personal links of my interpreter Monika Kondratiuk, a lecturer in the University of Białystok in Poland (Table C.4 in Appendix C).

home, while some export their own products to Europe, US and other parts of the world. The extent of their exports ranges between 1% and 5% of sales for four of them and 11-25% for the other four. All the clothing firms function as subcontractors to foreign customers abroad, and this output accounts for 60-90% of the production of six of them, while the other two firms report 25-50% and below 25% of their production respectively. None of them have exports of their own products. The share of exports in the production of firms is in line with the expectations of the characteristics of the industries, so the sample appears to be a good representation of the industries.

All the firms in the sample were established well before the transition and were brand-owners in the Polish market. The latter is a particularly important point for the clothing firms as it serves as evidence for the marketing and branding capability of these firms in the domestic market that distinguishes them from the clothing firms, which produce only for export markets through being inserted into GVCs/GPNs. Hence, in contrast to most of the earlier work on upgrading through GVCs/GPNs, this research's sample of firms allows us to examine the upgrading concept not only with a view that is not only unaffected by the lock-in effects of GVCs/ GPNs but also allows us to observe the impact of both export- *and* domestic market-oriented networks on firm-level upgrading.

The characteristics of the firms chosen in our sample allow us to distinguish the firms studied from SMEs and start-ups (i.e. firm size) as well as from firms with no inheritance of a strong, reputable brand that is associated with a high level of production capability accumulation in both industries. They also allow us to compare two groups of firms with respect to their export intensity. None of the firms in the sample is involved in R&D to provide us with R&D expenditures. The age of the firms does not apply in the context of transition, while the year of privatisation might be relevant. However, except for two state-owned enterprises in the food-processing industry that were still awaiting privatisation at the time of the fieldwork, all had been privatised by 1996. The sample also consisted of three privatised SOEs with foreign and/or domestic strategic investors.⁸⁶ Despite the expectations for differences between privatised and state-owned firms with regard to their upgrading, looking at their differences with our sample would create bias due first to the predominance of privatised firms in the sample and second to

⁸⁶The only dairy cooperative in the food-processing industry is included within the 100% domestically owned privatised SOE category of firms.

the strong networking capability of state-owned firms chosen (on the basis of the pilot questionnaire, which was confirmed with the fieldwork).⁸⁷ Finally, since in general the firm characteristics were implicitly contained in the definition of the sample, it was not needed to insert ‘firm characteristics’ as a set into the analysis.

4.3.3 Data Collection Methods

As noted above, the conceptual framework of this research is tested through empirical work with data collected from large domestic firms operating in the food-processing and clothing industries in Poland. In order to achieve a comprehensive understanding of the relationship between networks and firm-level upgrading, this research was conducted at the firm level instead of the industry level, but it will place firms in the context of the meso environment of the ‘industry’ or ‘sub-sector’ that surrounds them, not least because this is a key determinant of their strategy (cf. Porter, 1990).

4.3.3.1 Primary data collection: Face-to-face interviews

The pilot questionnaire results showed that face-to-face interviews would inevitably be needed. Therefore, the main data was collected through face-to-face interviews. As Lyles (1988: 306) put it, “[t]his methodology was appropriate because information about a firm’s learning is not available outside the firm, it requires an in-depth analysis, and learning is a lagged phenomenon”. The fieldwork of this research consisted of two visits to Poland in May and November 2001. A letter stating my wish to visit their company was faxed to the respective companies in each industry. All of the appointments were confirmed by phone. Since there was a potential language barrier in the research, well-qualified interpreters, arranged through personal contacts, accompanied me in all the interviews during both visits. They were used when necessary.

Types of interviews conducted: As can be seen in Table 4.4, two types of interviews were conducted: Semi-structured interviews that targeted the core firms (Appendix D) and open-ended interviews that targeted public and private organisations, some of

⁸⁷ The number of relationships of the two SOEs in the food-processing industry shows a good performance with a total of 36 relationships. Three privatised former SOEs with (domestic and/or foreign) strategic investors had a total of 122 relationships and three 100% domestically owned privatised former SOEs had a total of 37 relationships. All of the clothing firms are 100% domestically owned privatised former SOEs and have a total of 272 relationships.

which were partners declared by the interviewed firms (Appendix E). Both types of interviews followed a set series of questions serving as a structured guide for the researcher, and interviewees were allowed, and even encouraged, to expand on relevant topics where they were especially knowledgeable. While preparing the interview questions, the Community Innovation Survey (CIS) (1997) and the interview questions and techniques used by Tsekouras (1998), Salter (1999) and Santos Pereira (2000) were consulted in addition to the relevant literatures. The strategic nature of the interview questions' content lay in the focus on detailing each relationship in which some form of knowledge was transferred to the firm. Altogether, 31 semi-structured and 19 open-ended interviews were conducted (Table 4.4).

Table 4.4 Distribution of face-to-face interviews by industry and types of interview

		<i>Types of Interview</i>			Total
		<i>One-to-one</i>	<i>Group</i>	<i>Spin-off</i>	
<i>Semi-structured interviews</i>	Food-processing firms	12	4	0	16
	Clothing firms	9	4	2	15
<i>Open-ended interviews</i>	Organisations	13	3	3	19

Source: Own fieldwork

Semi-structured interviews conducted in this research took the form of either one-to-one interviews with only one person or group interviews with two or more people with similar qualifications in their specialisation or in different fields of activity. Group interviews are considered as one interview. Sometimes I was fortunate to find a manager transferred from a firm in the sample who was also able to express objective opinion about the previous firm. In such cases, one interview covered more than one firm. Additionally, sometimes interviews included people who were called in by the main interviewee to give correct information, rather than a guess. These kind of interviews were referred to as 'spin-off' interviews. Out of 50 interviews, the majority of the interviews were one-to-one (34). Only 11 were group interviews, and 5 were spin-offs. The balance in favour of one-to-one interviews is a positive point since in most of the firms, more than one one-to-one interview was done, which was not only a preferable method but also produced better results in terms of collecting more and more objective information, with possibilities for double-checking. As many as four individuals were interviewed in a given firm, either separately or in groups. Each firm interview took at least 4 hours.

Open-ended interviews were conducted with researchers in the public and private research institutions, academics at the universities in food-processing and textile and clothing departments, and people in organisations such as Chamber of Commerce, accreditation organisations, and statistical institutes. These interviews were conducted in order to triangulate the information received from the firms, to collect information about their activities in the industry or for the industry, about the past and present of the relationships between these organisations and the firms, and about their views on the state of the industry as well as the changes in the respective industry throughout transition.⁸⁸ There were 19 such interviews with 10 organisations (Table E.1 in Appendix E).

The departments visited in the universities were chosen because they are the only universities with these specialised departments in Poland that firms referred to with regard to employing their graduates and cooperation undertaken. One of the public research institutes was selected for interviewing because it was mentioned by one of the food-processing firms as research collaborator. The other was chosen on the basis of its ability to survive despite the widespread closure and collapse of textiles and clothing industry-related public research institutes during the post-socialist transformation. These visits aimed to verify the nature of relationships described in firm interviews and to explore the current situation of links between industry and the S&T sector in Poland. Central Statistical Office (GUS), Polish Centre for Testing and Certification (PCBC) and the Polish Agency for Foreign Investment (PAIZ) in Warsaw were visited to gather information on firms as well as expertise information and statistics regarding innovation, quality certification and foreign investment in the industries researched in this study. Researchers at the think-tank CASE (Centre for Social and Economic Research) in Warsaw shared their expertise on the firms and industries researched in this study.

⁸⁸ A limited number of the foreign partners were sent questionnaires and asked about their views of the core firms, in particular their view on the level of their upgrading during their relationship. 8 responses to 15 questionnaires sent to the foreign partners were received. This approach was also chosen in order to ‘triangulate’ the information received from the core firms. However, the responses do not cover a wide range of the core firms interviewed and therefore achieve the purpose of triangulation only to a limited extent.

Information about the interviewees in semi-structured interviews: Semi-structured interviews were conducted with leading individuals in the core firms who were responsible for and knowledgeable of the current and past collaborative experiences of those firms. They tended to be the managers at top and middle managerial levels (ranging from general managers to production managers, marketing managers, purchasing managers, quality assurance managers and finance managers), as recommended by Håkansson (1987). However, they did not necessarily have degrees in management. Depending on the area of the manager, they may also have been researchers, engineers or simply workers who had worked for the firm for many years before becoming managers in a specific area. Therefore, they were the people in whom the firm's knowledge base, existing capabilities and the history of the firm's relationships were mostly embodied (Kim 1998a),⁸⁹ as well as the most able people to observe and assess the impact of a specific relationship on the firm with respect to learning and upgrading.

In general, the interviewees were open and cooperative. Upon my (the researcher's) wish to visit the production site, they were suggesting to meet other people in the firm such as the staff engineers, production chiefs, etc. who could show me the production site. Sometimes the production managers showed the factory themselves and explained the production processes and technology they had, or if the factory was in another city on my route they arranged a visit – another opportunity to interview with more people in the same firm. During the factory visits, structured conversations were held with operational managers, production chiefs, senior and junior engineers, yet they were more in the form of a casual meeting that took place after an interview with the main interviewee. These structured conversations were a useful technique of double-checking the information received from the managers, since these people very sincerely and sometimes proudly explained the details of, for instance, an arm's length relation with a technology supplier, clarifying to what extent the firm was capable of using, assimilating, changing, modifying or improving the technology being acquired over time. They served the purpose of direct observation to assess the changes happening in

⁸⁹During the years this research was conducted, i.e. the transition years, particularly the young managers with management degrees had high turnover rates, which prevented them from giving sufficient information about the past, and sometimes even the present, of the firm's relationships. However, they always directed me to people in the company who could answer my questions. They proved to be the best initial contact in the firm, due to their interest in research conducted by foreigners.

the firm as a result of its relationships with external partners, as Garvin (1993: 90) states that “there is no substitute for seeing employees in action”. These structured conversations are not counted as interviews per se.

Design of the interviews Semi-structured interview questions were prepared and designed to retrieve information first about the general background regarding their own activities and history of the firm, and then the particularity of each relationship the firm is/was engaged in and the learning that occurred in that relationship. This allowed the triangulation of data-collection methods.⁹⁰ During interviews, two methods were successfully exploited. First, instead of forcing the interviewees to remember relationships unprompted, a method of reminding them of possible relationships / partners was used, and this led them to focusing on the question asked rather than diverting their attention to find relationships irrelevant to our research. In this way, a significant number of relationships was revealed, which sometimes the firms themselves were not aware of. Second, instead of asking about the types of relationships directly (e.g., “what are your arm’s length (AL) relationships? Or does your firm have any AL relationships?”), relationships with specific types of partners were asked about. This method led ‘me’ to determine the type of the relationship in question according to the literature instead of ‘them’ speculating. In addition, as I elaborated the details of one relationship, this method allowed the interviewee to remember and disclose other relationships with the same or similar partners or with similar important consequences to their upgrading.

In order to increase the comfort of the interviewee in his/her communication throughout the interview, the relationships easiest to remember were asked about first. The order of partners about whom questions were asked was suppliers (technology suppliers, suppliers of raw materials), customers, complementary and competitor firms, followed by universities, public and/or private research institutes, R&D labs or centres, consultants and/or consulting firms. At the end questions about relationships with partners such as export/intermediary agencies, design agencies, human resource or advertising agencies, chamber of commerce or industrial associations, and

⁹⁰ Although the firm data collected through interviews can be seen as anecdotal, they are triangulated by interviews with R&D institutes and other governmental institutions as well as the use of Polish official statistical data.

governmental institutions were asked. Once a particular relationship was brought up, consecutive questions aimed at detailing the characteristics and the ways the relationship contributes to firm-level upgrading were asked. Each question was repeated for on-going and past relationships occurring any time from 1989 to 2002.

4.3.3.2 Secondary data collection

In addition to the interviews, information used for triangulation of interview data was collected. As detailed in Table 4.5, these sources consisted of site observation, documentation related to the companies, researchers and so on, and secondary sources such as business magazines, journals, newspapers, and the online resources.

Table 4.5 Informal sources of information

Visit to factory / production unit	<ol style="list-style-type: none"> 1. To observe the situation of the factory and the state-of-the-artness of the technology in use (as mentioned during the interview) 2. To learn about the details of the production process 3. To observe the workers, the machinery and equipment, the site, warehouses, etc.
Documentations	<p><i>Primary sources:</i> Company annual reports, Any kind of presentation of the firms in English and in native languages, Previously prepared documents on the history of the firms, Recent financial statements / production volumes / rankings, Product catalogues, Documents prepared by the personnel for different purposes (e.g. the mottos of the company written by the general manager for the workers, a technical document written by the chief of the design room on the functioning of the design room for the seasonal workers from vocational schools, etc.). Technical papers written by the university academics, researchers in the research institutes. Statistical data. Specialised information from governmental organisations in electronic-format (firms that obtain ISO certificate from PCBC, results of a project that some food-processing firms joined, etc.).</p> <p><i>Secondary sources:</i> Business magazines, journals, newspapers.</p>
Online research	To be informed about the firm visited in preparing specific questions and not to lose time with basic information available online.
The papers of the ESRC project	Within this project, I worked as the research assistant, and produced two clothing and four food-processing firm case studies as well as industry studies.

Source: Author

Documentation collected during the visits was useful in several different ways during the analysis and writing up. Online resources provided general company information about their operations before the interviews and were used as background information

for a well-prepared interview with the respective firm. The firm and industry case studies that were been carried out within the ESRC project were utilised for generalisation and contributed to the descriptive analysis of this research.

4.3.4 The dataset of relationships and its reliability

Based on the face-to-face interviews with 16 firms (8 in food-processing and 8 in clothing), a dataset composed of 467 relationships was constructed (Table 4.6). It is completely derived from the field research in Poland. In other words, the interviews created a unique database for the network relationships of large domestically-owned firms in the Polish food-processing and clothing industries. There have never been readily available data on relationships of either these firms or other firms in either industry in Poland before. As a result, the extent and type of information in this database is unavailable elsewhere.

The dataset displays the intrinsic characteristics of each relationship that includes knowledge transfer (i.e. excludes simple market relations) and its impact on the types of upgrading within the firm by means of the factors explaining and facilitating learning in networks. Table 4.6 presents the basic characteristics of the dataset, which displays/ includes a well-proportioned number of relations in each industry. The relationships of the food-processing firms account for almost 42% of the dataset, while those of clothing firms represent almost 58%. The minimum number of relationships per firm is 10 in the food-processing industry and 22 in the clothing industry and the maximum number of relationships is 44 in the food-processing industry and 47 in the clothing industry.

The average number of relationships of privatised food-processing firms with foreign and/or domestic strategic investors is 30.5 (with min 10, and max 44). 100% domestically-owned privatised firms in food-processing industry do not present an impressive performance with an average of 18.5 relationships per firm (with min 13, max 24). This indicates that the presence of a foreign strategic investor not only affects the networking performance of food-processing firms but also facilitates the integration of Polish firms into their own or other foreign networks that significantly increase their number of relationships. Clothing firms are all privatised and domestically owned with an average number of 34 relationships per firm.

Table 4.6 Basic characteristics of the dataset

	No of firms	No of relations	% in total relations	Average number of relations per firm	min/max no of relations
<i>Food-processing</i>	8	195	41.8	24.4	10/44
<i>Clothing</i>	8	272	58.2	34.0	22/47
<i>Total</i>	16	467	100	29.2	10/47

Source: Own data

As mentioned above, out of 50 large food-processing and 29 large clothing firms with more than 500 employees, eight companies in each industry were secured through face-to-face interviews following a sampling strategy that includes pilot questionnaire survey. They all met the most important criterion for the choice of firms for this research (i.e. firms with relevant type of networking relationships that included knowledge transfer). The interviews revealed similar pattern with regard to network size and network density in both of the industries studied (Table 4.7), strengthening the results of our analysis with regard to their comparison. “Network size is measured by the number of the firm’s direct dyadic ties” (Hite and Hesterly 2001: 278- footnote 5), and network density of the firms is defined as total number of relationships of a firm divided by the total number of relationships in an industry.

Table 4.7 Network size and network density of the firms in the sample: A comparison of food-processing and clothing firms

<i>Food-processing firms</i>	<i>Network size</i>	<i>Network density</i>	<i>Clothing firms</i>	<i>Network size</i>	<i>Network density</i>
Meat processing	44	0.23	Men’s and women’s overcoats 1	47	0.17
Poultry	36	0.18	Men’s suits 1	46	0.17
Fruit and vegetable preserves	32	0.16	Men’s shirts, light dresses	38	0.14
Dairy	24	0.12	Men’s suits 2	36	0.13
Sugar	21	0.11	Women’s light clothes	34	0.13
Drinks and beverages	15	0.08	Men and Women’s light clothes, knitted clothes	26	0.10
Potato processing	13	0.07	Underwear/nightwear	23	0.08
Confectionery	10	0.05	Men’s and women’s overcoats, light dresses 2	22	0.08
Industry total	195		Industry total	272	

Source: Own data

As a result, it is clear that domestic firms are operating in such a competitive environment that they constantly seek for new sources for meeting their needs. In contrast to what is commonly believed, they are not short of linkage capabilities to establish relationships. However, it should be noted that it is not the number of relationships but their content that paves the way for upgrading.

4.3.5 The unit of analysis: The relationship of the firm

The unit of analysis of this research is *the relationship of the firm*. The analysis of upgrading is frequently discussed at the ‘meso’ level (i.e. industry), while the case study methods required the unit of analysis to be at the ‘micro’ level (i.e. firm). This research will stay within the boundaries of ‘micro-level’ perspective of inter-organisational relations, namely *dyadic* relations in networks.

Although the importance of networks (as a mode of governance) is stressed in the recent upgrading literature that uses the GVC framework, network relationships have not been widely used as an analytical tool. Other than the efforts of Ernst, there is no link between the literatures that use networks (linkages, interactions) as unit of analysis (e.g., innovation systems) and the process of upgrading at the firm, industry or country level. Firms are acknowledged as the active components of networks, and yet the relationships between firms and other organisations have an interactive effect (i.e. generation of new thinking and capabilities by means of interaction with parties that have knowledge) (Håkansson 1990). Defining the boundaries of networks also varies according to the intentions, perspectives and interpretations of various actors (Håkansson and Johanson 1988, Carlsson and Stankiewicz 1991). Therefore, in the absence of methodological tools that address the analytical limitations of the upgrading literature (mentioned in chapter 2), this thesis takes a network approach to upgrading by defining its boundaries from the perspective of relationships in them, which to my knowledge has not previously been attempted at all.

Moreover, this thesis is based on the premise that in order to capture the contribution of learning mechanisms in networks to firm-level upgrading, the focus of our analysis needs to shift away from the industry and the individual firm to the ‘dyadic’ relationships of firms in networks. Like Nelson and Winter (1977) and Freeman (1994), who believed micro-level studies of innovation were more likely to produce fruitful results than aggregate production functions, I believe firm and industry-level studies, although useful on their own right, examine value chains/production networks at too high level of aggregation by not going into detail of each relationship in the value chain/networks. Each individual relationship in the chain might have its own nature, depth and frequency, varying not only with respect to industry but also with respect to

the contribution to various types of upgrading within the firm. Recently, to capture the effects of different type of relationships on firm-level process and product upgrading through quantitative methods, McDermott and Corredoira (2010) used the number of these relationships with specific organisations in their model, where the unit of analysis was the firm. What is still missing with such an analysis is the ability to reflect on the dynamics of processes such as learning that take place in each relationship and affect the upgrading types at the firm-level.

According to Lu and Burton (1998: 167), the network approach is methodologically powerful because it helps in examining “the two-way relationships of a single actor and the convergent relationships of one actor linking numerous units” as well as allowing “a comprehensive analysis of structural features such as the exchange of information, knowledge, goods and services, and ... the density and essence of ties between multiple actors”. Therefore, employing the network approach bases the analysis of this research on “the nature of the relationship between and among the exchange partners” (Uzzi 1996: 682), which have become an important unit of analysis (Dyer and Singh 1998). Hite and Hesterly (2001) call a set of direct, dyadic ties and the relationships between these ties, with the firm at the centre of the network as the focal actor, an ‘egocentric network of a firm’. They argue that “the evolution of a network necessarily includes and builds from the simultaneous evolution of dyadic ties” and suggest a “dual level of network analysis, with simultaneous focus on both the network dyads and the aggregation of the dyads into the larger network” (*ibid.* p.277). In other words, ‘each dyadic tie between two partners’ becomes an analytical tool that allows for examining “the characteristics of systems of interdependent dyadic relations” (Johanson and Mattson, 1987: 45) and their impacts on the firm-level upgrading for the purposes of this research. As a result, compared to the previous works on upgrading, the strength and novelty of this research lies in its unit of analysis.

4.4 TIME DIMENSION: PERIODS IN TRANSITION YEARS

4.4.1 Capturing a dynamic analysis

As discussed in section 2.2.3.1.b, the GVC characterisation of the input-output relationships between buyers from advanced countries and suppliers from emerging market countries is a *static description*. For a *dynamic analysis* of such relationships

transfer of knowledge and the development of learning capabilities in emerging market firms over the years have to be considered. One of the most important elements of the network analysis is the change over time (see Powell *et al.* 2005). It is also important in the learning / capability accumulation processes, in which most of the typologies of ‘stages’ used to date do not contain the time dimension (Bell 2006, Schmitz 2006).⁹¹ A *dynamic* analysis is necessary for understanding how the networks of firms have evolved and how the effects of learning in these networks on firm upgrading have changed over time (Schmitz 2006).

The focus of this research is on the ‘transition years’. This period in post-socialist countries is particularly rewarding for capturing change, being a period of exceptional speed and extent of change across a gamut of dimensions that would be difficult to find in other regions. In this period, countries (like Poland), that have been members of the European Union (EU) since 2004, were still outside the EU but greatly affected by preparations for accession. The initial conditions of the transition economies were believed to be not conducive to understanding the advantages of networking and the importance of upgrading (Radošević 2002, 2004, Dyker 1997, 2004b).⁹²

Looking at networking relations dating back as far as possible is important because of ‘path dependency’ (Nelson and Winter 1982, Pavitt 1987), due to which the future upgrading opportunities of firms are strongly related to what they have been capable of doing in the past. Considering the change of management in most of the firms with the transformation, overcoming a potential recall problem was not possible. A limited number of relationships before 1989 were remembered and mentioned during the interviews. However, because they did not provide enough evidence for a comparison of the pre-transition with transition years they are excluded from the dataset and therefore will not be covered by the actual analysis, but they will be referred to when

⁹¹ “Distinguishing between producers at an incipient and an advanced stage seems therefore helpful in examining the learning effects. Examining the relevance of this distinction requires research which captures change over time” (Schmitz 2006: 556).

⁹² Radošević (2002) discusses the need for regional restructuring in CEE in the post-socialist period due to: the concentration of economic advancement in a few areas, mainly capitals and regions with diversified economic structure; polarisation of mono-structural regions into those witnessing economic recovery and those that did not, and closure of the branch plants of multi-plant ex-socialist firms as these large firms sought to maintain labour in their core plants.

convenient and necessary during interpretations of the analysis results.⁹³ Moreover, a comparison of the transition years with years before 1989 would not necessarily contribute to our understanding of firm upgrading in these industries in Poland due to the nature of the economic system then prevailing, which had its own special dynamics.⁹⁴ For this reason, this research examines the relationships starting in 1989, the year of transition from central planning to a market economy, and extends to 2001 when the fieldwork was conducted.

In order to capture the evolution of upgrading through networking, the time dimension in the relationships is represented by ‘periods’ instead of ‘number of years’, which has been frequently used in the research on networks. Upgrading is a process that can best be examined in stages or periods. Also, networks tend to be long-term relationships, but this does not necessarily exclude the possibility of medium or short-term relationships that bring in knowledge to the firm. Moreover, despite longer duration, some networks might be ‘weak ties’ and some short-term networks might be ‘strong ties’ (to use the terms of Granovetter 1973)⁹⁵; there is no rule regarding the relationship between the duration and strength of these ties. Hamel (1991) argues that whether learning successfully takes place in a relationship may not be understood with the use of proxies, such as the duration and stability of the relationships. In addition, in a few cases, the interviewees did not know the exact year that the relationship had started and therefore precisely how long it had continued (i.e. recall problem). The time variable most useful for this study appeared to be the one that shows the evolution of the networks and as a result the learning in these networks, rather than the main concerns of the network theorists. Instead of focusing on the number of years a relationship continued (as there

⁹³ There are altogether 19 relationships declared by the interviewees dating back to the period of planned economy. Of these 19 relationships established before 1989, 11 of them were declared in the clothing industry. This is due to the presence of Outward Processing Trade (OPT) relations before 1989 which continued for a little while after the transition (as mentioned in section 2.2 in Chapter 2). The special legal status of the OPT relations between West and East Europe has been abolished but in fact the practice is continued in the form of cut-make (CM) and cut-make-trim (CMT) contracts in GVCs/GPNs. Most of the relationships before 1989 in the food-processing industry were either technology acquisition from abroad or cooperation with public research institutes, centralised research centres of group companies, and universities within the country, or export opportunities with CMEA and/ or Western countries through the foreign trade organisations (FTOs) operating at that time; today the latter have been evolved into the normal exporting relationships that can be found in any typical market economy.

⁹⁴ There are limited but significant studies on communist economies that shed light on the operations of firms in those years (see Chapter 5).

⁹⁵ Weak ties here is that the weak ties, as Granovetter (1973) emphasises, have an important role “as information transmitters among people, but due to lack of information codes they are not benefited as much as in the case of strong ties” (Gelsing 1992: 117).

may be relationships still continuing, in which case it is captured through the variable ‘continuity of the relationship’), focusing on the periods during the transition years in which a relationship had started provides us with insight about the evolution of networking activity over the transition years. Hence, the firms interviewed were asked questions about when the relationship had started. The interviewees also declared whether the relationship had ended or was ongoing. As mentioned earlier in section 4.3.4.1, the interviewees consisted of managers, engineers and researchers who were the key informants on the relationship investigated.

4.4.2 Determining the time periods

The time periods into which transition years are divided are determined according to the policy development in Poland during those years. Based on the association between the GDP growth rates and the economic reform packages and policies, there are tendencies to examine the Polish economy during 1989-2001 in four periods in the literature on transition economies (Belka 2001; Kołodko 2005). According to this approach, the first period, called the *transformational recession* (a term coined by Kornai 1995)⁹⁶, is shaped by the “shock therapy approach” (associated with Sachs *et al.* 2000; cf. the ‘gradualist approach’ of Kornai 1995), adopted by the first democratically-elected Polish government, and covers the period from 1990 to 1993. In this period, aiming at macro-economic stabilisation, the Polish economy quickly oriented itself to the principles of market economy through strategic policy changes and comprehensive economic reforms. The liberalisation and stabilisation measures of these years, namely the Balcerowicz Plan, aimed at fighting against inflation and reducing external debt through strict budgetary and monetary policies, price and trade liberalisation (i.e. phasing out of price controls and trade protection), opening markets to international competition through allowing economic activity of foreign investors and private persons as well as abolishing the state monopoly in international trade, and hardening the budget constraints of state-owned enterprises through eliminating most direct subsidies to these enterprises and gradually privatising them (Balcerowicz 1993).⁹⁷ In the long term, they “have been fundamental in helping to foster a rapid expansion of the new private sector,

⁹⁶ The reasons why the period 1989-1993 is referred to as a ‘transformational recession’ are explained in section 4.3.1 above.

⁹⁷ http://en.wikipedia.org/wiki/Balcerowicz_Plan, and http://en.wikipedia.org/wiki/Economy_of_Poland.

a contraction and restructuring of the state sector and a profound re-orientation and rapid growth of international trade” (Gomulka, 2000: 19-20). The initial result of these reforms was the successful reversing of the significant output decline in 1990 and 1991 (around 15%, according to Gomulka 2000: 4) as early as 1992, making Poland the first former centrally planned economy to end its deep recession - the shortest among those countries - and start its recovery of output (IMF 1997: 7, Carlin and Landesmann 1997). Following this period, both the food-processing and clothing industries have been gradually undergoing transformation in concert with the changes in the global structure of these industries.

The second period covers years with strong GDP growth between 1993 and mid-1998 (*early revival* from mid-1992 to late 1994 and *growth acceleration* between 1994 and mid-1998). For three successive years, Poland enjoyed economic growth with an average rate of 6% of GDP per annum. In these years, both export-led growth (1994-95) and rising domestic demand (1996-97) allowed strong improvements in Polish competitiveness and the inflation rate slowed from around 30% in 1994-1995 to 20% in 1996 due to the exchange-rate based stabilisation strategy (IMF, 1997). Poland surpassed the pre-transition level of output in 1996 (IMF 1997: 7; Rapacki 2001:108), with falling inflation and unemployment levels. Intensive modernisation and inflow of FDI started. The third period of *growth slowdown* lasted from mid-1998 to 2002, with the economic policies of the new government targeting “cooling down the economy” to lower the high inflation levels and current account deficit, with negative effects on GDP growth, which fell from 6.8% in 1997 to 4.8% in 1998 and then to 1.4% in 2002. The Russian crisis in August 1998 affected the overall Polish economy only briefly; by mid-1999 domestic demand revived the economy again (OECD 2000). Based on my interviews, particularly with the clothing firms, this crisis had significant adverse effects on their export-based production activities, which suddenly became expensive for their foreign customers compared to south-east European countries (as a result of appreciation of the zloty) and caused them to lose those customers. The fourth period (not covered by this research) begins in 2002 and is based on the “public finance recovery program” with the aim of integration with the EU.

Therefore, taking the GDP growth rate of Poland into account, this research will divide the 1990-2001 into three periods: the transformational recession, or ‘the early 1990s’

(1989-1993), growth acceleration, or ‘the mid-1990s’ (1994-1997) and growth slow-down, or ‘the late 1990s’ (1998-2001). Recent studies on Poland use this division of time periods as it also reflects the economic changes in the light of political changes. For instance, a model of internationalisation stages in the Polish food-processing industry was built on these time periods of economic transition, with 1990-1993 representing the collapse of the industry when faced with fierce foreign competition after the implementation of liberalisation and privatisation strategies (a period of shock) and 1994-2002 an adjustment period that was divided into two sub-periods as: 1994-1997, a period of adjustment to the new competitive environment, and 1998-2002, when the local market was regained (Blanke-Lawniczak 2009). Although statistics show a decline of clothing industry after 2001, in the transition period (1989-2001, like any other industry, the clothing industry presents a similar trend to the food-processing industry.

As mentioned in section 3.4.1, the industrial production statistics of the food-processing and clothing industries reveal that the real turning point for these industries with regard to the effects of transition is 1999. This is going to be kept in mind during the analysis. The time periods are used either to show when a particular relationship occurred (i.e. started and ended within that period) or had started (and continued in the following period or periods).

As a result, my analysis aims at shedding light on network development and its influences on the firm-level upgrading by incorporating the historical context in terms of the major changes in Poland’s policy and macro environments during transition years. The distribution of the relationships established by the firms in our sample in these transition periods can be found in Table 6.3 (total row). It shows that more than half of the relationships in both industries were established after 1998. Also, while the relationships established by food-processing firms tripled in the mid-1990s as compared to the early 1990s, those of clothing firms increased by only around 7 percentage points from the early- to the mid-1990s.

4.5 EXPLORING THE VARIABLES AND OPERATIONALISATION OF THEIR CATEGORIES

In this section, the analytical approach to each factor that relates networks to firm-level upgrading as drawn from the literature is explained in accordance with the research

model. It also introduces the variables and their categories as they are going to be used in a two-level analysis (Tables 4.10 and 4.13). Rather than explicitly formulating detailed hypotheses on the effect of each factor, an exploratory approach is preferred.

4.5.1 Inter-organisational level of analysis

Drawing on earlier network studies that singled out various characteristics of networks (e.g., Håkansson 1987, Axelsson 1995, Moeller and Wilson 1995, Gelsing 1992, Simonin 1999, Powell and Grodal 2005), this research builds a group of network-related factors that are distinguished under the sub-headings of characteristics of relationship, partners and the knowledge transfer within the relationship. In the inter-organisational level of analysis, the research model suggests ‘learning mechanisms external to the firm’ to be a function of these selected network characteristics in order to examine what attributes of the relationships influence the way firms learn in these relationships.

4.5.1.1 Dependent variable: Learning mechanisms external to the firm

The theoretical foundations of this variable and its categories as used in this research are explained in detail in section 3.2.3. The lack of empirical work documenting the effects of participation in networks on firms’ upgrading possibilities is attributable in part to the difficulty of measuring ‘learning’.⁹⁸ This research is not interested in measuring the effect of learning on *overall* firm-level upgrading as an outcome, but in understanding the contribution of additional knowledge and skill acquisition (Bell 1984) that occurs through each relationship to *one of the types* of firm-level upgrading as an outcome. So instead of discussing whether firms in our sample per se upgraded or not, and what this is due to, it will be possible to discuss whether a particular learning mechanism in networks (and therefore a particular network type) contributes to a particular type of upgrading (e.g., product upgrading) in Polish LMT firms.

⁹⁸ In much of the literature, measuring learning is approached through ‘learning and experience’ curves that measure output and are constrained to costs and prices, and ‘half-life’ curves that work on any output measure and target short-term improvements. Both measurement methods failed to capture the systemic changes that relied on conversion of tacit knowledge to coded/explicit knowledge and hence took a longer time to digest (Garvin 1993: 89). Moreover, the previous literature stresses learning as a cumulative process that increases the firm’s knowledge stock and capabilities (section 2.3). Although theoretically highly relevant, empirically this definition is difficult to capture through quantitative methods. Figueiredo (2010) points to the extensive use of innovation surveys that are not able to capture the nature of learning processes in emerging market firms.

Acknowledging the presence of relationships where no learning takes place, each relationship of the firm is investigated in-depth to find out if and what new knowledge it added to the firm's existing knowledge stock, and how. Then, the variable represents learning whilst in a relationship. In this sense, it is a 'categorical' variable which is 'relationship-specific' and 'incremental in nature'.

More than elaborating *how* learning in each category takes place, the definitions of learning mechanisms external to the firm intrinsically rely on the type of partners (Table 2.2). It would have been misleading to decide about the learning mechanism each relationship employed only by looking at the type of partner, especially due to the idiosyncrasies of each relationship established. It is also clear that asking firms directly about which learning mechanism was operant in a given case would have not revealed reliable results.⁹⁹ Although I was initially direct about asking whether they learned anything new during a particular relationship with a specific partner during the semi-structured interviews, I corroborated the answer to this question with lots of elaborations (e.g. type of interaction between people, training given, nature of the knowledge transferred, and so on) and repetitions of the same question in different styles during the interview for double-checking with such as questions about what exactly the partner helped them to do or what the firm has learned from that relationship that they did not know before.

The elaborations on the stories of the relationships with the interviewees and the observations throughout the interview revealed how the firm learned during that relationship and helped me to process the retrieved information into the appropriate learning mechanism used during the relationship (Table 4.8). Moreover, the presence of learning in networks is substantiated by the ability of the interviewee to elucidate the contribution of the new knowledge acquired in the relationship to the firm, which also shows a conscious awareness of the alternatives that the new knowledge provides the firm (Friedlander 1983, quoted in Huber 1991). This constituted an assurance that learning was happening in some particular way that was unique to that relationship and

⁹⁹ As Lyles (1988: 306) notes, "[s]tatements of learning were perceptual and subject to individual biases and judgments", so in her research she used multiple informants in order to minimize this bias. During the interviews for this research, the information gathered from one interviewee was also double-checked with other interviewees as much as possible (section 3.4.4).

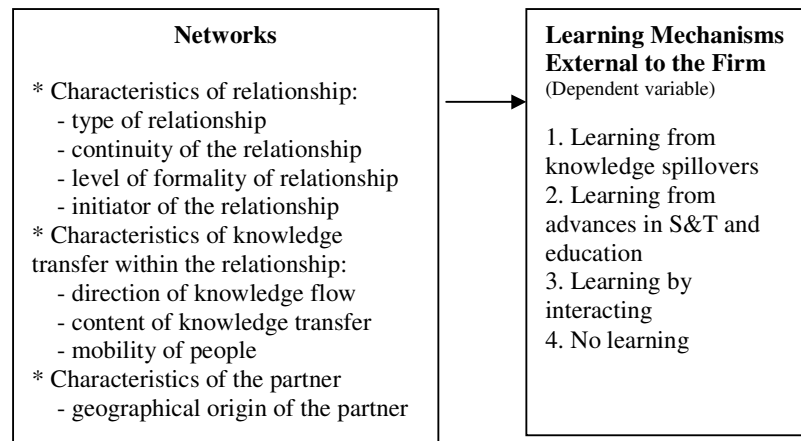
its dynamics, so that determining which learning mechanism played a role was not difficult.

To exemplify how the coding is done for the learning categories, we can take the example of a relationship between a global buyer and a Polish clothing supplier. The global buyer demands the Polish supplier to purchase a special interlining machine that makes the product look like handmade. This is a new knowledge/technology that Polish supplier had never heard of. Additionally, the global buyer tells where to buy it or gives choices about where to buy. Both pieces of information –about the machine and about where to buy it - are knowledge spillovers. The process of the technology purchase through arm's length relations with the technology supplier and the associated technical training is learning from advances in S&T. Once the new machinery is bought, the global buyer brings in the new product designs that are prepared to be sewn with this new technology. The Polish supplier not only gains new skills in using this new machine and perhaps becomes the first in its market to use and excel at it, but also is introduced to a completely new product design (with a new process technology) that can be imitated for its own brand in the domestic market. The former is learning by interacting and the latter is learning from spillovers if the firm engages in imitating.

4.5.1.2 What aspects of the relationship influence learning in networks?

This section introduces the variables that are expected to affect learning in networks. They will be used in the analysis of the first sub-research question of this thesis: How does learning take place externally through networks? The independent variables of this analysis are grouped in three characteristics of networks (hereinafter 'network characteristics' in short): characteristics of the relationship, characteristics of the partner and characteristics of knowledge transfer within the relationship. The learning mechanisms external to the firm are a function of these characteristics (Figure 4.2).

A relationship is characterised by its embeddedness in the market (AL relations) and production or knowledge systems (section 3.2.1). It is also characterised by its being a formal or informal relationship, its continuity and its initiator. The nature of knowledge transfer within a relationship can be described by whether knowledge flow is uni- or bi-directional; in what area the knowledge transferred is specialised; and whether there was mobility of people or not as a facilitator of knowledge transfer.

Figure 4.2 Relating Networks to Learning

This research is interested in the partners (i.e., organisations from which the knowledge is acquired) and their geographical origin (foreign or domestic). Since the definitions of the categories of the variable ‘learning mechanisms external to the firm’ involve the type of partner, it is eliminated from the analysis but will be used during the interpretations of learning mechanisms external to the firms. It will also be used in association with the type of networks in the descriptive analysis in Chapter 6. The list of these factors is not exhaustive. Below, the factors that are expected to influence learning in networks are explored.

a. Characteristics of the relationship

Variable 1 - Network type (NETYPE): The variable ‘network type’ is defined as the broad category of network of which a particular relationship of the firm is a part. Four types of networks are derived from the literature (section 3.2.1). The knowledge transfer is expected to involve more codified and less tacit knowledge in market-mediated networks such as arm’s length relations, and more tacit knowledge in networks of production, distribution and knowledge (Table 4.9). Drawing on the upgrading literature, in this research, the ‘governance’ elements of GVCs /GPNs are represented in ‘production networks’. However, knowledge networks represent a more open and flexible perspective based on reciprocal, preferential, and mutually supportive relationships (i.e. the network approach).

The examples in Table 4.9 are not exhaustive. They should be taken as guidelines to show that a relationship with a raw material supplier might have different dimensions, e.g. can be a relationship for a specific product development project (production network), involve training to show how to use the raw material effectively (knowledge network), or simply purchase of a sophisticated intermediary good as a group of firms (arm's length relationship).

The firms interviewed were not asked directly to put their relationships into one of these categories, as this practice was not successful in the pilot questionnaire. The terms used in the academic world and the business environment are different. So, it is preferred to ask questions about relationships in relation to type of partner the firm is engaged in (section 2 in the interview questions in Appendix D). Once the presence of a relationship with a specific partner is determined, then the nature of the relationship is elaborated.

Variable 2 - Who initiates the relationship (INITIATOR): Learning in networks is related to who proactively selected the partner and initiated the relationship: the partner or the firm. The network literature emphasises that firms put considerable effort to find the right/compatible partner to cooperate with, who will offer complementary capabilities and knowledge for the specific purposes of the cooperation (Hagedoorn 1993, Simonin 1997, Ahuja 2000, Chung et al.2000).

An emerging market firm initiating the relationship is expected to have a strong vested interest in actively seeking some specific knowledge from the right partner - knowledge that is difficult to access through other sources or in-house R&D and search efforts (this refers to its learning intentions) - as well as in sharing its own knowledge with a partner whose complementary capabilities will add value to its own operations (this refers to its strategic goals), e.g. in the supply chain. However, the ability to initiate the relationship is a significant sign of 'linkage capability' (Lall 1992) development.¹⁰⁰ Intending to be an active learner does not rule out the possibility of obstacles/barriers to tap into the

¹⁰⁰ Lall (1992: 168) defines linkage capabilities as "the skills needed to transmit information, skills and technology to, and receive them from, component or raw material suppliers, subcontractors, consultants, service firms, and technology institutions. Such linkages affect not only the productive efficiency of the enterprise (allowing it to specialize more fully) but also the diffusion of technology through the economy and the deepening of the industrial structure, both essential to industrial development."

knowledge sources of the partner or make use of the available knowledge by the partner (i.e. absorptive capacity) (Grant 1996).

The extent of knowledge transfer and sharing also depends on the level of interaction, trust and hierarchy between the partners and on the partner's willingness to share its knowledge (Inkpen 1998, Tatikonda and Stock 2003, Schmitz 2006). Partners with a better knowledge stock may be protective and reluctant to share knowledge to prevent unintended knowledge transfer (Hamel *et al.* 1989, Inkpen 1998); however, the predominant disbelief of the foreign partners in the capabilities of an emerging market firm to capitalise on spillovers of the partner's knowledge may ease this barrier (based on the partner questionnaires conducted by the author). A foreign partner with complementarity of capabilities may have an interest in governing the relationship (Heide 1994), making the emerging market firm a passive participant to the relationship but allowing relatively higher access to knowledge with more open regimes of information disclosure (Owen-Smith and Powell 2004). Moreover, the partner's motives for initiating the relationship and the extent of willingness for knowledge sharing may vary for other reasons (these topics are dealt with thoroughly in the literatures on the choice of entry mode by MNCs and technology acquisition modes by firms).

So, who initiates the relationship is significant in the context of emerging market firms in LMT industries, whose upgrading initially relies on knowledge transfer from external sources rather than internal efforts alone. The firm's initiation of the relationship indicates developed linkage capabilities and an active learning intention by the firm, while the partner's initiation can be taken as an indication of its willingness to share its knowledge and allow knowledge spillovers in the relationship. This variable is based on section 3 of the interview questions in Appendix D as well as further elaborations of these questions as required during the interview.

Table 4.8 The variable *Learning mechanisms external to the firm* and its categories with descriptions based on observations from this research

Categories of learning mechanisms external to the firm in this research	Associated type of partner	Illustrative cases based on the observations from this research
Learning from academic and industrial spillovers in a relationship	Competitors, firms operating in similar industrial specialisation but not necessarily competitors, (such as global customers who are brand manufacturers), other horizontally-related firms, universities, and research institutes	<p><u>By means of:</u></p> <p>Strategic investor's supportive activities in managerial, technical, technological and/or scientific matters,</p> <p>Cooperation with sister companies' research/product development units for product or process development, and among managers to keep track of new developments in their market,</p> <p>Managerial and technical harmonisation after merger with a horizontally-related firm,</p> <p>Participation in conferences, seminars, scientific meetings that universities or industrial organisations such as Chambers of Commerce arrange,</p> <p>Interactions at personal level in trade shows and fairs where competitors and horizontally-related firms participate,</p> <p>Distribution licensing of a brand of a foreign horizontally related firm,</p> <p>Visits to production plants of the partner or to machine supplier companies before technology acquisition,</p> <p>Technical assistance by the representative of foreign partner located in the firm for a certain period of time to guide the production processes and training provided by that person within the firm in order to improve the firm's production and technical capabilities to the desired advanced level of the foreign partner,</p> <p>Observing the products a foreign customer has requested or ordered and the associated production processes the customer taught or the machinery it leased,</p> <p>Personal informal contacts with academics at the universities,</p> <p>Presence at the firm of post-graduate students and post-doctoral fellows as part of their degree work or joint projects (cf. Murray 2002).</p>
Learning by interacting in a relationship	Suppliers, customers, users; complementary firms and organisations in and/or related to the industry	<p><u>By means of:</u></p> <p>Subcontracting of a complementary firm for production purposes or of raw material suppliers (such as farmers in the food-processing industry) with whom extensive scientific training is undertaken by the firm to introduce new advanced S&T techniques,</p> <p>Technical training by raw material supplier firm as to how to make use of its product in different ways,</p> <p>Training by the global buyers and their technicians situated within the firm,</p> <p>Projects with design firms, consulting firms for adapting and improving technical, organisational and managerial processes, for problem-solving,</p> <p>Organisational and managerial training outside the company by consulting firms and universities</p> <p>Marketing agencies before launching a new product on the market,</p> <p>Market or product-related demands and feedbacks of wholesalers or hypermarkets,</p> <p>Feedback loops between the firm and its supplier and customer.</p>
Learning from advances in S&T and education in a relationship	Technology suppliers, universities, research institutes, laboratories, specialised consulting or intermediary firms for international technology transfer	<p><u>By means of:</u></p> <p>Technology acquisition and technical training during technology acquisition,</p> <p>Licensing process technology,</p> <p>Contracting research to the university, research institutes or labs for new ingredient, product, or process development,</p> <p>Personal contacts with academics at the universities, generally for problem-solving in production processes,</p> <p>Participation in advanced training and/or postgraduate programs of universities for technical, technological or scientific improvements,</p> <p>Hiring skilled people, consultancy services for international technology transfer,</p> <p>Accepting and paying PhD students or interns from the universities to study their topic in the firm,</p> <p>Participation in research projects run by university as 'application' partner,</p> <p>Joint projects with consulting firms for quality management (e.g. in food-processing industry) in order to get specific certifications and/or for IT-related managerial training,</p> <p>Participation in machinery exhibitions and interactions at personal level.</p>

Source: Based on Malerba (1992) and von Tunzelmann and Wang (2007) with elaborations from own fieldwork.

Table 4.9 The variable *Network type* and its categories with descriptions based on observations from this research

<i>Network type</i>	<i>Description of relationships observed in this research</i>
Arm's length relations	Machinery and equipment purchases; Technology purchases in the form of R&D contract and licensing; Contracting of R&D activities to universities and research labs; Intermediary agents (e.g. for finding customers, improving marketing and distribution); Market research agents; Participation in fairs and exhibitions; Participation in conferences, seminars and symposiums; Cooperation with human resource development and recruitment agencies, advertisement agencies, design agents, consulting firms, industry associations, Chambers of Commerce, etc..
Distribution (and marketing) networks	Cooperation / strategic alliance in distribution with competitor, distributor or complementary firms; Licence agreement for marketing and distribution; Franchising; cooperation between wholesaler/retailers and the firm's sales representatives (in the form of feedback for product improvement and /or development, training, etc.).
Production Networks	Subcontracting (outward processing, OEM); Licensing for production; Cooperation with competitors, customers, suppliers (e.g. training, technical and organisational assistance and advice, etc. for attribute or component pricing system ¹⁰¹), with complementary firms in the industry (e.g. for new product and process manufacturing), with sister firms and strategic investor.
Knowledge Networks	Relationships with other firms (such as sister firms, strategic investor firm, supplier firm, user firm, complementary firms, etc.) in product and process improvement and/or development, quality improvement, scientific advice, experimentation, etc.; Cooperation with universities, public and private research institutes, R&D laboratories, technology suppliers, etc. (e.g. for new product and process development, access to new advances in S&T, technological improvements of production processes); Relationships developed with individuals who obtain specialised knowledge on the basis of personal acquaintance; Firm visits and observation (e.g., among partners); Relationships including/based on technical and organisational assistance, advice and training (e.g. from technology suppliers, raw material suppliers, universities, design agents, consulting firms, industry associations, Chambers of Commerce); Relationships with consulting firms for re-organisation of production process, product-market strategy development; Cooperation with universities, consulting firms, etc. for training in business functions, planning, design and technology management.

Source: Own fieldwork

Variable 3 - Continuity of the relationship (CONTINUITY): Earlier studies pointed out the importance of long-term and stable inter-firm relationships for developing the high level of interaction that brings about interpersonal communication in greater magnitude and frequency as well as with richer/denser and more complex knowledge (Hägg and Johanson 1983, Håkansson and Johanson 1988, Simonin 1997, Tatikonda and Stock

¹⁰¹ This system is about offering "suppliers price premiums when the raw product they deliver has more than the average amount of the desired component and/or discount the price paid to the supplier when they deliver product with substandard amounts of the desired component. The essential criterion is that the firm purchasing the input has the technical capability to measure the components or attributes when they make the purchase" (Connor and Schiek, 1997: 254). Essentially, this system introduces interaction between supplier and the firm (i.e. farmer, in the case of food-processing industry) for the technical training of the former by the latter.

2003).¹⁰² The frequency of the use of the source of knowledge in networks is sometimes on a regular basis. Relationships with organisations like universities, research institutes, consulting firms, and so on are often not continuous but occasional or regular relationships, and can be used as complementary to the in-house competence of R&D (Freeman, 1991) or as a substitute for the lack of it. Technology acquisition packages tend to be one-off type relationships, unless firms are happy with the technology and the after sale services of a particular technology supplier and go back to the same supplier years later to upgrade the technology.

Learning opportunities do not decrease as the continuity of the relationship decreases; however, continuous relationships tend to improve the elements of trust and knowledge about the partner in the relationship. This has significant consequences with regard to reduction of uncertainty in the future behaviour of the partner (Thorelli 1986, Galaskiewicz 1985, Gulati 1995) and is expected to become an impetus for further learning (Inkpen 1998). Relationships with the same partner for a long term or in regular intervals also mean developing a 'networking experience' (i.e. past experience, prior ties) that allows more knowledge transfer and spillovers from the partner leading to improved learning performance. This allows the firm to develop the capability to extract learning from the partner easily (Heide and Miner 1992, Inkpen 1998, Kim and Inkpen 2005).

So, the variable 'continuity of the relationship' is defined as the frequency of establishing relationship with the same partner, as a source of knowledge. It is categorised as continuous relationships (i.e. uninterrupted since the relationship started), occasional / regular relationships (i.e. relationships occurring at irregular or infrequent intervals, e.g. when needed by the firm or the partner, or on an annual basis¹⁰³); and one-off relations (relationships occurring once and no more). This variable is based on answers to questions in section 6 of the interview questions in Appendix D and further elaboration as required during the interviews.

¹⁰² The counterargument that continuous relations are prone to stagnation in the relationship is not relevant in our research due to the assumption of the significant 'partner differences' with regard to their knowledge bases.

¹⁰³ Annual relationships occur once a year (e.g. with public research institutes for tests, accreditation, etc. or technical fairs, conferences, symposiums). They are mostly compulsory relationships with public laboratories or institutions that require some tests to be undertaken on a yearly basis.

Variable 4 – Level of formality of the relationship (FORMALITY): Informal mechanisms/networks between individuals and within groups of people such as employees of partner firms or organisations with common professional interests and specialisation (Czepiel 1974, Von Hippel 1988, Grant 1996) are one of the main carriers of knowledge between firms in product development, technical advice for problem-solving in production processes, and so on (Dosi 1988, Kogut and Zander 1992, Pyka 1997, Mason et.al., 2004; von Hippel 1988, Ernst and Kim 2002, Dahl and Pedersen 2004). Communication of individuals at an informal level through telephone, email and fax help codification / articulation of tacit knowledge (Pak and Snell 2003), and has significant impact on emerging market firms during technology acquisition projects and in export-oriented production, as verbal forms of instructions and specifications are most often supplemented with written materials at an informal level.¹⁰⁴ They are mostly treated as positive externalities, creating strong links between the networking and knowledge spillovers, e.g., through observation that may lead to reverse engineering (Ernst and Kim 2002).

Formal mechanisms/relationships, on the other hand, are organised or determined by managers in the form of resource and personnel exchange, teamwork, secondment, teams and task forces, meetings and organised personal contact, as well as arranged visits among the partners, organised training, technical consultancies, standard machinery transfer, etc. (Bell 1984, Ghoshal and Bartlett, 1990; Nohria and Ghoshal, 1997, Makhija and Ganesh 1997, Ernst and Kim 2002, Pak and Snell 2003, Bönnte and Keilbach 2005, Noorderhaven and Harzing 2009). Learning is expected to be higher in informal relationships compared to formal ones, with more spillover effects.

So, the variable ‘level of formality of the relationship’ tells us whether the contact is based on arrangement and/or agreement by the top-level managers (i.e. formal) or on contacts among individuals, particularly in the form of individual networking to build and maintain personal relationships with other individuals such as scientists, engineers, middle-level managers in other firms and organisations (Mason *et al.* 2004). This variable is based on questions in section 7 of the interview questions in Appendix D and further elaboration as required during the interview.

¹⁰⁴ Networks play a central role in codifying the knowledge as much as possible in order to facilitate its dissemination among the partners through the use of ICTs (section 1.2.2).

b. Characteristics of knowledge transfer process within the relationship

Characteristics of the knowledge transfer process during the relationship determine the strength of the ‘glue’ that keeps these dispersed and complex networks together (Ernst 2006, Ernst and Kim 2002).

Variable 5 - From whom to whom (DIRECTION): In the evolutionary literature, there are attempts to classify network types according to the direction of the flow of knowledge and resources (Hagedoorn and Schakenraad, 1990; Freeman, 1991; Britto, 1998; Hagedoorn and Sedaitis 1998, Noteboom, 1999). Traditional one-way or uni-directional knowledge flows in inter-firm agreements (particularly in technology purchase, licensing, subcontracting, and so on) are distinguished from two-way or bi-directional knowledge flows in strategic partnerships in R&D, technology, production and distribution (see for instance, Freeman and Hagedoorn, 1994; Mytelka, 2001). Mytelka (2001) explains the differences between the two on the basis of joint knowledge production and sharing, little or no equity involvement, and requirements for longer-term planning as opposed to opportunistic responses to short-term gains. In general, the basis of knowledge transfer within the non-equity based relationship (as studied in this research) is most often uni-directional (Narula 1996).

So, the variable ‘direction of knowledge flow’ is defined on the basis of whether knowledge and resources flow uni-directionally either from the firm to the partner (i.e. outflow) or from the partner to the firm (i.e. inflow), or bi-directionally (i.e. mutual flow) among the partners.¹⁰⁵ Uni-directional knowledge transfers create limited opportunities for learning (Mowery *et al.* 1996); however, in the emerging market context, they are expected to facilitate learning in networks more than bi-directional relationships. This variable was easily driven from the nature of the knowledge transfer within the relationship. Questions in section 10 of the interview questions in Appendix D and their further elaborations as required during the interview formed this variable.

¹⁰⁵ In our sample of relationships, a representative example for knowledge outflow from the domestic firms is the relationships between the food-processing firms and their contracted farmers.

Variable 6 - What kind of knowledge is transferred (CONTENT): The knowledge content of the relationships differs according to the need of the partners.¹⁰⁶ There is ‘market knowledge’, sought when a firm is entering into a new market for the first time and needs to compensate for its own ignorance by accessing its partners’ knowledge of and networks in that market, or when joining forces to be strong in different markets (such as supply markets). It is defined as

“knowledge held by consumers as well as firms in the market. Due to the nature of market transactions, knowledge available in the market tends to be highly codified and explicit, but there can be a certain degree of tacit and culture-specific knowledge, such as consumer preferences. Organisations often acquire and utilize market knowledge through intermediaries such as advertising agencies, market research firms, and consulting firms” (Simonin 1999b:466).

Then, there is knowledge on ‘business and quality management’, which involves the introduction of new routines within the firm as well as the ability to manage inter-firm contractual relationships. Especially quality management, involving a fair amount of training, is an increasingly important issue with regard to international standards. Firms generally cooperate with specialised universities and consulting firms to get prepared and certified as well as get training on specific management courses and programmes or enjoy networks with strategic investors and synergies within group companies. It is also a significant part of firm strategy against FDI-led competition in the Polish market (Gorynia and Wolniak 2000). A third type of knowledge is ‘technical knowledge’, such as on new products, product specifications and/or designs and their production processes, leading to adaptations and minor improvements in these production processes or the products or to development of new products, new production processes. This knowledge comes from various forms of subcontracting relations and user-producer interaction (e.g., Rothwell and Gardiner 1983, Westphal *et al.* 1984, Håkansson 1987, Mytelka 1991). A fourth is ‘technological knowledge’, most often embodied in process technology¹⁰⁷ and problem-solving activities (Westphal *et al.* 1984, Dosi 1988, Kogut and Zander 1993;) and sourced from technology suppliers, universities, research institutes, global buyers, and so on. Finally, organisations that deal with scientific research are the only source of ‘scientific knowledge’ for firms without

¹⁰⁶ “Collaborations between companies can have a large variation in content and take many forms” (Håkansson 1990a: 376).

¹⁰⁷ Process technology is not the same thing as the process upgrading. The former is the method of production of a product whereas the latter is the efficiency increase in this method.

in-house R&D that feeds development of new products, processes or services (Witt and Zellner 2009).

The variable ‘content of knowledge transfer’ is defined as the kind of knowledge that is transferred, aiming at complementing the deficiencies in the firm’s knowledge stock. It is categorised as *market-related* (knowledge on markets, market actors and market activities, or information on market for raw materials, technology, machinery and equipment, or products in the market, e.g. from fairs and exhibitions); *production-related* (organisation of production, technical knowledge, product specifications, design, product quality); *technology-related* (process technology, scientific expertise and advice, technological knowledge) and *business and quality management-related* (management, quality management, administration, marketing and distribution). The coding of this variable is based on answers to questions in section 10 of the interview questions in Appendix D and further elaboration as required during the interview.

Variable 7- How knowledge is transferred (MOBILITY): The importance of face-to-face communication for the transfer of person-embodied (tacit) knowledge is widely acknowledged in the relevant literature. Such communication can take many form, including sharing experience, demonstration and observation, master-apprentice relationships on the shop floor, personal instruction, provision of expert services (advice, consultations and so on), solving problems and training between different people at different levels in the form of personal contacts, group level dialogue and discussion (Hamfelt and Lindberg 1987, Johnson 1992, David and Foray 1995, Senker and Faulkner, 1996). Unquestionably, individuals are regarded as the key nodes for the transfer of tacit knowledge (Nonaka 1994), which therefore requires *mobility of people*. Codified knowledge in the form of technological blueprints and specifications or licence agreements are not enough on their own. One of the reasons behind the success of reverse-engineering in developing countries lies in the mobility of skilled people such as experienced engineers and managers between the technology supplier and technology acquirer firms (Mowery and Oxley 1995, Kim 1998a, 2001). It gained significant importance in the spread of export-oriented production in developing countries (i.e. GVCs/GPNs) (Saliola and Zanfei 2009). The knowledge transfer used to make reverse engineering a success took the form of formal training of engineers and management personnel within the group companies and strategic investor and

secondments and exchange of personnel for some period (O'Donnell and Blumentritt 1999, Inzelt 2008) as well as specialised training provided by universities and consulting agencies, which contributed short-term mobility of personnel (Criscuolo 2005). Mason *et al.* (2004) call for further research using quantitative techniques to assess the importance of highly qualified labour mobility in knowledge transfer from the external environment.

So, the variable 'mobility of people' is defined as the presence and absence of mobility of skilled people in the relationship. This variable is based on the answers to questions in section 9 of the interview questions in Appendix D and further elaboration as required during the interview.

c. Characteristics of the partner

The literature on learning in alliances pays particular attention to the partner similarities in knowledge and technology (Dyer and Singh 1998, Mowery *et al.* 1996, Lane and Lubatkin 1998). When there are significant partner differences, the learning opportunity is enhanced (Inkpen 1998, Kim and Inkpen 2005). The international technology transfer and FDI-spillover literatures, in the emerging market context, are premised on the idea that foreign partners should be able to bring in more up-to-date and state-of-the-art knowledge to the relationship than domestic partners. The upgrading literature emphasises 'global' value chains for the same reason. Therefore, relationships with foreign organisations are expected to create more learning opportunities for emerging market firms.

Variable 8: Geographical origin of partner (GEORIGIN): Accordingly, the variable 'geographical origin of partner' serves to differentiate whether the partner is foreign or domestic. It will help us to shed light on the questions of where the sources of knowledge and knowledge spillovers are for emerging market firms. Here, foreign partners include organisations located abroad as well as FDI, whereas domestic partners are indigenous organisations located in Poland.¹⁰⁸ The firms interviewed were simply asked whether the partner was foreign or domestic. This variable is based on the

¹⁰⁸ Here, the country or regional origin of the partner is not distinguished in order not to complicate the variable and the interpretation. However, in our sample, most of the foreign partners represent west European firms and organisations.

answers to the questions in section 4 of the interview questions in Appendix D and further elaboration as required during the interview.

4.5.1.3 Summary

In summary, Table 4.10 displays the variables introduced above, their categories and the way they are coded for the multinomial logistic regression analysis. They are going to be used in the *learning model* of Chapter 7.

Table 4.10 Variables of Network Characteristics used in the multinomial logistic model in Chap 7

Variable name	Variable code	Description of its categories
Industry type	INDUSTRY	if the firm is operating in the 1 food-processing industry, 2 clothing industry.
Time period the relationship started	PERIOD	if the relationship started in the period 1 1998-2001 (late 1990s), 2 1994-1997 (mid-1990s), 3 1989-1993 (early 1990s).
Network type	NETYPE	if the relationship is established within a(n) 1 knowledge network, 2 production and/or distribution network, 3 arm's length relation.
Initiator of the relationship	INITIATOR	if the relationship is initiated by 1 the firm, 2 the partner.
Continuity of the relationship	CONTINUITY	if the relationship is 1 continuous, 2 occasional/regular, 3 happened once.
Level of formality in the relationship	FORMALITY	if the relationship is 1 informal, 2 formal.
Geographical origin of partner/network	GEORIGIN	if the partner in the relationship is 1 foreign partner located abroad and in Poland 2 Polish partner
Direction of knowledge flow	DIRECTION	if the knowledge flow during the relationship is 1 uni-directional 2 bi-directional
Content of knowledge transfer	CONTENT	if the knowledge transferred during the relationship is 1 technology-related 2 production-related 3 business and quality management- related 4 market-related
Mobility of people	MOBILITY	if in the relationship there is 1 mobility of people 2 no mobility of people
Learning Mechanisms in Networks (Dependent variable)	EXTLEARN	During the relationship, 1 learning from knowledge spillovers 2 learning from advances in S&T 3 learning by interacting 4 no learning took place

4.5.2 Intra-organisational level of analysis

4.5.2.1 *Dependent variable: Type of Firm-level Upgrading*

The upgrading concept is operationalised by Humphrey and Schmitz (2004) by defining the types of upgrading in the firm's functions (section 2.2.2). Using 'types' of firm-level upgrading helps us to observe the 'hard to observe' incremental effects of knowledge processing within the firm through relationships (section 3.6.1.1). Moreover, this typology is suitable for exploiting it in statistical analyses for generalisation purposes.

This research re-defines the categories with some minor changes in order to reflect both production and knowledge systems as well as add a new category that reflects the empirical context examined (section 3.2.2). The operationalisation of the variable is based both on my observations during fieldwork and on the insights from earlier empirical work (see Navas-Aleman 2011) (Table 4.11). In order to justify the presence of upgrading in one of the types, questions were asked according to the definitions of new product and processes determined earlier on the basis of previous empirical work (see Appendix D for these definitions). There is a fifth category where no upgrading has been observed as a result of the relationship. This category emerges out of our empirical work and is substantiated by the evidence that being inserted into a GVC does not necessarily enable or guarantee upgrading (Navas-Aleman 2006).

This variable does not rely on the evaluation of the interviewees; it is not a perceptual variable but an objective variable based on the outcomes that were present or about to happen. Statements by the interviewees regarding the contribution by any of the firm's relationships to any of the firm-level upgrading types were corroborated through my actual observations during the fieldwork. The firms interviewed were asked questions about the outcome of the external knowledge acquired through each relationship or gains from the relationship: whether the relationship contributed to a change in the firm's products, processes, other operations, and if so, what in particular the relationship with a specific partner improved in the firm, such as management, technology and product development, production, marketing and distribution, design, logistics, and so on. Questions were detailed with examples to help the interviewee, and when the interviewee was able to elucidate the contribution of the new knowledge acquired from the relationship to a particular upgrading type in the firm as an actual or potential outcome, then I was again assured that there had been learning in some particular way

that was unique to that relationship and its dynamics. This variable is based on the answers to questions in section 12 of the interview questions in Appendix D and further elaboration as required during the interview.

4.5.2.2 Contribution of Learning in Networks to Firm-level Upgrading

This section introduces the factors that are expected to contribute to various types of firm-level upgrading. They will be used in the analysis of the second sub-research question of this thesis: *How does learning in networks contribute to firm-level upgrading?*

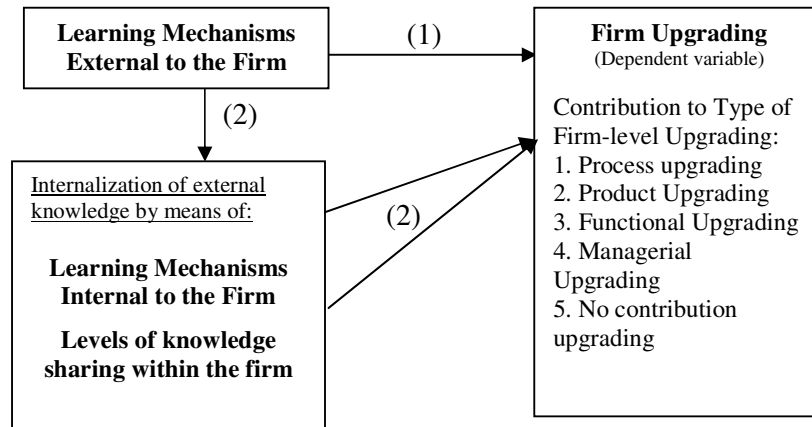
As discussed in section 3.2.3, firm-level upgrading is a function of learning mechanisms external to the firm. To overcome the gap in the literature with regard to the interaction of inter-organisational with intra-organisational knowledge transfer, Easterby-Smith *et al.* (2008) suggest that researchers should employ a wider view of knowledge transfer at the inter-organisational level that encompasses knowledge transformation and integration at the intra-organisational level.

As mentioned earlier, linking the ability to acquire new skills and resources externally to the ability to generate internal expertise is at the core of learning in networks (Lundvall 1996, Powell and Grodal 2005). If the same information is delivered to agents that have different cognitive and absorptive capacities, the results will differ (Penrose 1959). To make effective internal use of externally acquired knowledge firms have to learn internalisation (Cohen and Levinthal 1990, Hamel 1991).

Table 4.11 Type of firm-level upgrading

Type of firm-level upgrading	Definition	Operationalisation	Food-processing industry	Clothing industry
<i>Process upgrading</i>	Increasing the efficiency of existing technological processes within the firm by means of minor and major change capabilities, by re-organising the production system or introducing superior technology	Investments in new machinery and equipment and new technology, introduction of advanced process technologies (such as CAD, CAM, CIM, EDI, MRP/MRP II, automated storage and retrieval systems, technical data network or factory network, resource planning in production department, etc.), introduction of HACCP/ISO, introduction of new manufacturing processes, technical training of workforce, changes in layout of the production processes and changes in production practices	In: Veterinary, microbiology, cooking/heating, freezing, ingredients, process chemistry, mechanical engineering, automation, packaging / bottling	In: Garment dyeing/knitwear, design and engineering, CAD/prototyping, pre-assembly (grading, marking, layering, plotting, cutting), materials handling/ conveyors/ new systems, assembly (fusing, sewing, pressing/ironing, finishing), packaging and warehousing)
<i>Product upgrading</i>	Introducing new products either through creative adaptations of competitor's / customer's products or improving existing products of the firm by means of minor change capabilities and use of higher-quality inputs	New brands, new models, new lines, new materials, new ingredients, new style; use of quality supplies, change in technical characteristics	New formulation, technology or packaging, or for a new market, a new positioning	New material, new design, new style, new market, new positioning, or new technology
<i>Functional upgrading</i>	Increasing value added by adding new, or withdrawing old, activities conducted within the firm, or moving the locus of activities to different links in the value chain (for example from manufacturing to design)	Developing new functions that production units were not responsible for during communist regime, such as purchasing, sales, marketing and distribution, design, quality. Includes developing capability to purchase inputs from foreign markets, design own products, launch own products, coordinate own supply chain, market and distribute own products, enter new markets, and so on.		
<i>Managerial upgrading</i>	Improving the efficiency and effectiveness of production and non-production activities by acquiring new forms of organisational and managerial methods, or by re-organizing the existing managerial activities in the way to endorse means of internal and external learning	New organisational and/ or management techniques, introduction or improvements of total quality management, managers and workers training and attainment of qualifications, increased usage of computing systems, internet/intranet for business purposes		

Source: The first three definitions are derived from Kaplinsky and Readman (2000) and Humphrey and Schmitz (2004); the last definition belongs to the author.

Figure 4.3 Relating Learning in Networks to Firm-level upgrading

Source: Author

This research examines the process by which externally acquired knowledge is internalised within the firm through *sharing* it at different levels of the firm and through creating new avenues for learning mechanisms *internal* to the firm, for those capabilities to do so were deficient before being involved in networks (Ernst *et al.* 1998, Kim 1997). Moreover, it tests these key concepts as *mediating factors* between learning external to the firm and firm-level upgrading (Baron and Kenney 1986). Therefore, firm-level upgrading also becomes a function of learning mechanisms external to the firm and the absorption / internalisation processes once external learning is achieved (Figure 4.3). Again, rather than explicitly formulating detailed hypotheses on the contribution of each independent variable on the firm-level upgrading types, an exploratory approach is preferred.

a. Learning mechanisms external to the firm: In the intra-organisational level of analysis, this will be used as an independent variable to assess the contribution of external learning mechanisms to firm-level upgrading types. In the inter-organisational level of analysis, where the aim is to understand the role of networks in learning, it is used as dependent variable. Its categories are the same as explained in section 3.6.1.1.

b. Learning mechanisms internal to the firm: This variable does not refer to creation of knowledge by internal sources of the firm, but to the adoption, and adaption of, externally acquired knowledge using internal mechanisms in order to upgrade some

Table 4.12 The variable *learning mechanisms internal to the firm* and its categories with descriptions based on observations from this research

Sources of knowledge (von Tunzelmann and Wang 2007)	Categories of learning mechanisms internal to the firm in this research	Illustrative cases based on the observations from this research
From production	Learning by doing + Learning by imitating + Learning failing	<ul style="list-style-type: none"> -simply doing the manufacturing activity as it is shown to the employees to implement, -replicating externally acquired knowledge for new product development, for entering into new markets, for creating new niches in the domestic market and so on; -replicating externally acquired knowledge for transfer of best practices, for on-the-job-training; -transforming externally acquired specific technological or scientific knowledge into a new product or process development by people in research and product development unit, for instance to develop a product or process new to the firm or to its market; -applying externally acquired knowledge to the production process, so repetitively that it is assimilated as if it has not come from outside the firm which over time leads to some minor changes in production process or product development as a result of accumulated experience
From consumption	Learning by using + Learning by monitoring	<ul style="list-style-type: none"> -simply using externally acquired technology as it is shown to the employees; -using externally acquired technology or knowledge for a specific purpose within the firm; -transforming externally acquired data about the market into information which can actually be used by the firm, for instance by the management to shape its strategy for responding to changes in that market; -using the feedback from the customers and users regarding the sale of their products in the market for new product development, for market expansion and so on; -transforming externally acquired specific technological or scientific knowledge, e.g. from universities or research labs, into a new product or process; -transforming externally acquired specialised knowledge, e.g. in IT use for managers, mostly through outside training into organisational practice; -systematically monitoring what other firms, competitors, suppliers are doing in their market and what new products they are introducing, examining what the firm can do with its means to keep up with them
From search 'supply'	Learning by training and research	<ul style="list-style-type: none"> -sharing externally acquired knowledge for strategic planning or communities of practice within the firm; -sharing externally acquired knowledge between the researchers of the firm to use it for adapting and improving existing technologies in use, for experimenting on specific tasks that lead to trial and error experiences, and apply it in their research and product development; -informal and formal training in specific areas for specific purposes within the group companies, by sister companies, and within the firm, particularly following external knowledge acquisition or training by global buyers, by technicians of global buyers situated within the firm, by MNC subsidiaries as raw material suppliers to the firm, by technology suppliers, by university departments (can be in management, in product development, in production process improvements, in introducing new functions); -informal and formal training undertaken by means of hiring a specialised organisation or person within the firm, for example, in the reorganisation of production or introduction of new marketing strategies by a consulting firm; -informal and formal training practices within the firm with the aim of transferring the knowledge acquired externally (e.g. as a result of technology acquisition) or by employee(s) of the firm who were trained externally in specific subject area (including sales and distribution people, franchisees); -during a long-term relationship with suppliers (e.g. farmers), e.g., firm's agronomists work with each farmer, teach and supervise them how to make most out of their harvest, experiment on the land, simultaneously do laboratory research, and finally reflect on the results of the yield each year to improve it next year; -training suppliers by employees of a firm that is OBM in the domestic market (while simultaneously being OEM in the export market), which requires the firm to set up a chain of suppliers and then to train its suppliers in the same way the global buyer trained

Source: Based on Malerba (1992) and von Tunzelmann and Wang (2007) with elaborations from own fieldwork.

functions of the firm. Table 4.12 presents its categories as drawn from the literature in association with the sources of knowledge (Malerba 1992, von Tunzelmann and Wang 2007) and matching observations from this research.

The firms interviewed were asked to detail the process of how the knowledge acquired through each relationship had been processed within the firm. After telling how the knowledge had been acquired during the relationship with a particular partner, the interviewees went on to provide the author with their story about how that knowledge had been internalised within the firm. This narrative information was processed by the author into one of the internal learning mechanism categories as in some examples shown in Table 4.12. This variable is based on the answers to questions in section 11 of the interview questions in Appendix D and further elaboration as required during the interview.

c. Knowledge sharing within the firm: Firms are distinguished from markets by their ability to share and transfer the knowledge of individuals and groups within the organisation through frequent communication, discussion, experience sharing and observation or teaching, working together closely and socialising activities with other individuals and groups at different levels within the firm (Brown and Duguid 1991, Kogut and Zander 1992, Ghoshal *et al.* 1994, Senker 1996, Goh and Richards 1997, Nohria and Ghoshal 1997, Inkpen 1998, Hansen 1999 and 2002, Dutrenit 2000, Brass *et al.* 2004, Barner-Rasmussen and Bjorkman 2005, Noorderhaven and Harzing 2009).¹⁰⁹ Similar to knowledge creation (Nonaka 1994), knowledge sharing within the firm is composed of a spiral of interactions through various connections that “starts at the individual level, moves up to the group level, and then to the firm level” (Inkpen 1998: 76). In the context of networks and the reverse learning trajectory of emerging market firms, a spiral of knowledge processing within the firm starts with the inter-organisational knowledge transfer from the partner, moves to the specialised unit level, then to the inter-unit level representing team-work within the firm and finally to the firm level.

¹⁰⁹ Dutrenit (2000: 50) argues that “firms assimilate knowledge all the time at different levels”, most of the time unconsciously, and lists a number of knowledge internalisation mechanisms (Dutrenit 2000:51, Table 3.2).

Empirically, Hansen (1999) uses inter-unit relations to understand the role of weak ties in sharing knowledge across organisational subunits in the search-transfer problem in MNCs. He defines inter-unit relations “as regularly occurring informal contacts between groups of people from different operating units in an organisation” (Hansen, 1999: 83). Brass *et al.* (2004) argue that firm performance and knowledge-related activities within the firm are influenced significantly by the patterns of inter-unit relations. By reviewing the literature, they present interpersonal ties among individuals in different units within the organisation as the most important antecedent for inter-unit relations, while the common antecedent for both interpersonal and inter-unit relations is found in the organisational structure and control mechanisms.

So, the variable ‘knowledge sharing within the firm’ serves to understand at what levels of the firms the externally acquired knowledge is processed within the firm: Knowledge sharing by interaction among employees of a unit (i.e. within unit), among individuals or groups of people from different units (i.e. inter-personal / inter-unit)¹¹⁰, and among individuals and/or groups of people from different divisions (if it is a group company) or at all levels of the firm by means of top or middle management sharing with everybody (i.e. divisional level / within the firm). The interactions at these knowledge sharing levels may be realised formally or informally; except in the last case, when all levels of the firm are involved; this is almost always formal. So, although there is no clear-cut boundary between the categories, they are ranked from most informal knowledge sharing to most formal.

The firms interviewed were asked questions about who in the firm shared the knowledge acquired through each relationship and how in order to understand the groupings between the individuals, units and divisions. Stories told by the interviewees were processed into one of the categories by the author. One example concerned an engineer who acquired certain knowledge on the process technology from the technology supplier, developed an idea, discussed it with the production and marketing manager in detail, and was given permission to try his idea with the help of a team composed of engineers and product design or brand managers, leading – after a few

¹¹⁰ Based on the findings of Brass *et al.* (2004) that inter-personal ties among individuals in different units within the organisation are the most important antecedent for inter-unit relations, I combine the two under one category.

trials – to the development of product x. This variable is based on answers to questions in section 11 of the interview questions in Appendix D and further elaboration as required during the interview.

4.5.2.3 Orientation of Firm Strategies

Another factor in the intra-organisational level of analysis that is expected to contribute to firm-level upgrading is the development of the strategic orientation of the firm for upgrading purposes as a result of experiencing access to knowledge through networks. Different types of networks bring about different learning possibilities and allow a healthier and more conscious strategy development within the firm. Externally acquired knowledge can provide firms with the guidance they needed and to help them to shape their firm strategies in a more professional way, particularly through helping them to understand their existing capacities to grow and thereby gain ‘new perspective’ in their strategy development. Each relationship an emerging market firm is involved in may help it to understand how to use its existing organisational practices for competence building and leveraging or to develop new practices, or may improve the firm’s awareness with regard to the evolution of its markets and help it develop strategies in that area. Therefore, networks become a tool for orienting firm strategies towards improving competitiveness or enhancing competences, depending on the nature of the relationship, the kind of knowledge transfer that takes place and the extent to which the externally acquired knowledge is internalised.

So, the variable ‘firm strategies’ is thus categorised as either a competition or a competence-oriented firm strategy. This variable is based on the answers to questions in section 13 of the interview questions in Appendix D and further elaboration as required during the interviews.

4.5.2.4 Summary

In summary, Table 4.13 displays the variables introduced above, their categories and the way they are coded for the multinomial logistic regression analysis. They are going to be used in the *upgrading model* of Chapter 8.

Table 4.13 Variables used in the multinomial logistic model in Chapter 8

Variable name	Variable code	Description of its categories
Industry type	INDUSTRY	if the firm is operating in the 1 food-processing industry, 2 clothing industry.
Time period the relationship started	PERIOD	if the relationship started between 1 1998-2002 (late 1990s), 2 1994-1997 (mid-1990s), 3 1989-1993 (early 1990s).
Learning mechanisms external to the firm	EXTLEARN	If the relationship leads to 1 learning from knowledge spillovers 2 learning from advances in S&T and education 3 learning by interacting 4 no learning took place
Learning mechanisms internal to the firm	INTLEARN	Within the firm, as a result of the knowledge transfer from the partner during the relationship, 1 learning by doing + learning by imitating + learning by failing 2 learning by using + learning by monitoring 3 learning by training + learning by research 4 no learning took place
Level of knowledge sharing within the firm	KNOWSHARE	If the knowledge is shared within the firm 1 Within the unit 2 Inter-personal/Inter-unit relations 3 Divisional-level in a Group company/Within the firm
Firm strategy	STRATEGY	If the firm pursues towards the relationship 1 competence-oriented FUS 2 competition-oriented FUS
Types of firm-level upgrading (<i>Dependent variable</i>)	UPGTYPE	If there is 1 managerial upgrading 2 process upgrading 3 product upgrading 4 functional upgrading 5 no upgrading

4.6 DATA ANALYSIS METHODS

As mentioned earlier, research on firm-level upgrading by means of GVCs is mostly limited to case studies; only very recently has statistical evidence been used in a few articles.¹¹¹ However, upgrading researchers have begun to note the need for quantitative analyses of value chains as well as studies of the dynamics of GVCs (Sturgeon and Gereffi 2009, Pietrobelli and Rabellotti 2011).

¹¹¹ “The GVC framework provides a conceptual toolbox, but quantitative measures are lacking. While the development of objective, industry-neutral measures of GVC governance is a laudable goal, and survey questions are currently being fielded to collect data on the governance character of inter-firm linkages in both cross-border and domestic sourcing relationships, better information to characterize the roles of firms, regions, and countries in GVCs is urgently needed. ... As a result, industrial output and trade statistics provide a very partial and even misleading view of where value is created and captured in the global economy” (Sturgeon and Gereffi 2009: 5).

This research, from the very beginning, constitutes an effort to depart from what has been done so far in favour of empirically based research that relies on a large cross-sectional dataset of relationships. From the outset, the research was designed for statistical data analysis of the qualitative information collected through in-depth interviews. Interview questions were designed in such a way that they could be turned into a quantitative dataset by means of categorizing the variables according to the analytical framework of this research. Using quantitative methods made it possible to generalise learning mechanisms and upgrading trajectories based on Polish LMT firms. The data analysis will be undertaken in two stages using Statistical Package for the Social Sciences (SPSS) version 17. It will allow generalisations - reliable and robust conclusions that do not suffer from the inevitable subjectivity of case studies. In this research, generalisations about the industry will also be possible through the use of econometrics.

4.6.1 Outline of empirical chapters

There are four empirical chapters. In the first empirical chapter (Chapter 6) cross-tabulations will be generated and synthesised first to draw a general picture of the networking relations of Polish food-processing and clothing firms within a dynamic framework. Illustrations and insights from my fieldwork material will also be utilised. The data collection method did not limit the ability of this research to generalise. The chi-square tests of the crosstabulations (i.e. non-parametric tests which show the statistical significance for bivariate tabular analysis; see Connor-Linton 2003) made generalising the results in this chapter possible. This chapter has a descriptive nature.

In the following two analysis chapters (Chapters 7 and 8), multinomial logistic regression (MLR) is employed as a statistical method to identify and differentiate the key factors that explain the nature of the relationship between networks and learning (Chapter 7) and that contribute to firm-level upgrading (Chapter 8). These chapters have a rather technical nature. The visual presentations of the data analysis methods therefore consist of tables, matrices and diagrammatic displays.

4.6.2 Relevance of cross-tabulations and multiple correspondence analysis

Cross-tabulations method will be utilised in Chapter 6 to map the network types in each industry in Poland, and then during model building for MLR analysis. The aim of using

cross-tabulations is simply exploratory. The method allows us to obtain summaries for the relationships between two categorical variables, and Pearson chi-square tests initially help us to confidently determine how strong the relationship between the variables is (at different significance levels).¹¹² In model building as well as crosstabulations, Multiple Correspondence Analysis (MCA) will be used for reduction of categories; however, this will be discussed in Appendix F instead of within the thesis.

4.6.3 Choice of Statistical Method: Multinomial Logistic Regression

This research uses a dataset with categorical variables¹¹³ that are not quantitative, numerical and continuous, but composed of two or more categories with no intrinsic ordering to these categories (therefore, they are called *nominal* variables). The statistical method that is going to be used in this research has to be in compliance with the discrete nature of the data. While chi-square statistical testing and cross-tabulations are useful statistical methods for indicating the degree of evidence of association between an independent and a dependent variable, the analysis of categorical variables is not restricted to them. They do not answer questions regarding the nature and strength of the association (Agresti, 2002).

MLR is one of the regression techniques that examine the effects of a mixture of categorical and numerical independent variables on a categorical dependent variable with three or more categories, as is the case in this study. Binary logistic regression could not be used because the dependent variable needs to have only two categories and independent variables need to be numeric. Linear regression could not be used because all variables need to be numeric. In addition, MLR, as opposed to (log)linear analyses or crosstabulations, allows us to determine *characteristics* that differentiate and/or are common in different groups (Hosmer and Lemeshow 2000, Borooah 2002, Greene 2003, Tabatchnick & Fidell, 2007, Petrucci 2009). The MLR model provides a more intuitive interpretation, not only due to its ability to examine several independent variables with a dependent variable (Tabatchnick & Fidell, 2007), but also due to use of

¹¹² The chi-square significance tests allow us to generalise from the sample used for the populations. “Typically, the hypothesis tested with chi square is whether or not two different samples (of people, texts, whatever) are different enough in some characteristic or aspect of their behavior that we can generalize from our samples that the populations from which our samples are drawn are also different in the behavior or characteristic” (Connor-Linton, 2003: online source). I will make use of them throughout the analysis.

¹¹³ Agresti (2002: 1) defines a categorical variable as a variable that “has a measurement scale consisting of a set of categories”.

odds-ratios, which will be described in detail below, as coefficient estimators for the independent variables (Petrucci 2009). Its major difference from linear regression is the use of predicted probabilities in the interpretation of estimates, since the dependent variable is now a probability (Winkelmann and Winkelmann 1997). Therefore, MLR seems to be the most suitable statistical method of analysis for this research for two reasons: 1) because this research is interested in finding out the ‘characteristics’ of networks that lead to learning, and 2) because the dependent variable has four unordered categories and its normality assumption cannot be reasonably assumed.¹¹⁴ SPSS version 17 is used for all the statistical models estimated in this research.

4.6.4 Introduction to the Multinomial Logistic Regression

The MLR model helps us to identify a “single decision among two or more alternatives” (Greene 2003: 719).¹¹⁵ This regression technique estimates the effect of independent variables on the natural log of the odds of the outcome of a discrete choice being outcome A, outcome B or outcome C as opposed to the comparison outcome D. For instance, it models the probability that a relationship leads to an external learning mechanism as a function of observed characteristics of that relationship. The four alternative learning mechanisms depend on a set of network characteristics, w , and are not ordered (nominal). Therefore, the external learning j that relationship i (Z_{ij}) leads to is given by

$$Z_{ij} = \beta'w_{ij} + \varepsilon_{ij} \quad (4.1)$$

In generalised logit model, $w_{ij} = [z_{ij}, x_i]$ where x_i contains characteristics of relationship i not depending on choices, while z_{ij} contains attributes of choices varying across choices and relationships. In this research, only characteristics of relationship (x_i) are relevant to our analysis, so a multinomial logit model is suitable.¹¹⁶

The multinomial logit model is defined as (Greene 2008, Hosmer and Lemeshow 2000, Borooah 2002):

¹¹⁴ Compared to linear regression, logistic regression makes no assumption about the distribution of the independent variables (e.g., for them to be normally distributed, linearly related or of equal variance within each group). As a result, the relationship between the dependent and independent variables is not a linear function but a logit transformation.

¹¹⁵ In multivariate probit models, for instance, there are several decisions, each between two alternatives (Greene 2003).

¹¹⁶ As compared to conditional logit models which incorporate only attribute effects and are applied when the data are choice specific, multinomial logistic models incorporate only a characteristics effect and apply when the data are individual specific (Borooah 2002).

$$\text{Prob}(Y=j) = e^{\beta'_{jx_i}} / \sum_{k=1}^4 e^{\beta'_{kx_i}} \quad (4.2)$$

$$\text{Prob}(Y=j) = \frac{e^{\beta'_{jx_i}}}{\sum_{k=1}^4 e^{\beta'_{kx_i}}} \quad (4.2)$$

and the related log-odds ratio ($\log(p_{ij}/p_{i0})$) as a linear function of K determining variables whose values for relationship i , are X_{ik} , $k = 1, \dots, K$ is (Borooah 2002):

$$\log \left[\frac{\text{Prob}(Y_i = j)}{\text{Prob}(Y_i = 0)} \right] = \log \left(\frac{p_{ij}}{p_{i0}} \right) = \beta_{j0} + \beta_{j1}X_1 + \beta_{j2}X_2 + \dots + \beta_{jK}X_K - Z_{ij} \quad (j=1, \dots, J) \quad (4.3)$$

where $\beta_{0k} = 0$ ($k = 1, \dots, K$) by definition, with J mutually exclusive outcomes indexed $j=1, \dots, J$, of a particular instance of external learning, relating to each relationship i ($i=1, \dots, N$).

The logit transformation of the individual/unique probabilities to the estimated equations with the assumption of $\beta_{0k} = 0$ ($k = 1, \dots, K$) and $Z_{i0}=0$ are then are (Greene 2008, Hosmer and Lemeshow 2000, Borooah 2002)¹¹⁷:

$$p_{ij} = \text{Prob}(Y_i = j) = \frac{\exp(Z_{ij})}{1 + \sum_{k=1}^J \exp(Z_{ik})} \quad j=1, \dots, J \quad (4.4a)$$

$$p_{i0} = \text{Prob}(Y_i = 0) = \frac{1}{1 + \sum_{k=1}^J \exp(Z_{ik})} \quad j=0 \quad (4.4b)$$

As explained above, each of these probabilities is expressed as a function of independent variables x and parameter vectors β , and the multinomial logistic model ensures that the probabilities are between zero and one for all possible values of x and β (Winkelmann and Winkelmann 1997, Greene 2003).

4.6.4.1 Reference category

One of the categories of the dependent variable (called ‘outcome’) is taken as the ‘reference or base’ category for comparison and its coefficients are set to zero. Any category can be chosen as the reference category. The last category of each independent variable is also used as a reference category and is set to zero. Hereinafter the reference

¹¹⁷ Setting $\beta_{0k} = 0$ ($k = 1, \dots, K$) is part of the normalization required to ensure the probabilities sum to one; in other words, only J parameter vectors to be needed to determine the $J + 1$ probabilities.

category of the dependent variable is called the ‘reference outcome’. So, in a four-outcome category model, MLR results form three logit functions comparing $Y=1$, $Y=2$ and $Y=3$ to $Y=4$ (Hosmer and Lemeshow, 2000, Borooah 2002):

$$\text{Logit (1)} \quad \log [\text{Prob}(Y_i=1) / \text{Prob}(Y_i=4)] = \beta_{10} + \beta_{11}X_1 + \beta_{12}X_2 + \dots + \beta_{1K}X_K = Z_{i1}$$

$$\text{Logit (2)} \quad \log [\text{Prob}(Y_i=2) / \text{Prob}(Y_i=4)] = \beta_{20} + \beta_{21}X_1 + \beta_{22}X_2 + \dots + \beta_{2K}X_K = Z_{i2}$$

$$\text{Logit (3)} \quad \log [\text{Prob}(Y_i=3) / \text{Prob}(Y_i=4)] = \beta_{30} + \beta_{31}X_1 + \beta_{32}X_2 + \dots + \beta_{3K}X_K = Z_{i3}$$

4.6.4.2 Estimation: Odds ratios

Interpreting the coefficient estimates is different in MLR than in linear and binary regressions.¹¹⁸ It is also difficult when the independent variables are categorical. This difficulty is overcome with the use of a measure of association called the *odds-ratio* (*OR*), which is defined as the *ratio* of the probability of outcome j to the probability of the chosen base outcome. “It approximates how much more likely (or unlikely) it is for the outcome to be present among those with $x=1$ than among those with $x=0$ The interpretation given for the odds ratio is based on the fact that in many instances it approximates a quantity called the relative risk” (Hosmer and Lemeshow 2000: 50). Therefore, instead of a positive coefficient implying that an increase in the value of that variable will lead to a rise in the probability of outcome j , a positive/negative coefficient on a variable implies that the *odds-ratio* increases/decreases with an increase in the value of the associated variable (Borooah 2001, Greene 2008). The use of odds-ratio for interpreting the estimates proves the logistic regression a powerful analytic research tool (Hosmer and Lemeshow 2000).

Equation 4.3 above, with outcome j compared to the reference outcome reveal different coefficient estimates for all paired groupings of the outcome variable. It also allows us to identify different effects of particular independent variables not only within each group but also as compared to the reference category of the independent variable. This is one of the main strengths of MLR when compared to binary logistic regression (Petrucchi 2009, Hosmer and Lemeshow 2000), although it poses problems in the interpretation of the coefficient estimates of odds ratios. In MLR, odds ratios become

¹¹⁸Compared to linear regression, Borooah (2001:5) explains the problem with interpreting the coefficient estimates from the multinomial logit equation 4.3: “[F]or example, $\beta_{jk} > 0$ does not imply that an increase in the value of variable k will lead to a rise in p_{ij} , the probability of outcome j for person i . It could be that the value of some other outcome increases even more, so that p_{ij} actually falls.” Compared to binary logistic regression, Hosmer and Lemeshow (2000:287) states that “fitting and interpreting results from a multinomial logistic regression model follows the same basic paradigm as was the case for a binary model. The difference is that the user should be aware of the possibility that informative comparative statements may be required for the multiple odds ratios for each covariate.”

relative risk ratios, whose calculation is the same as the odds ratio (i.e. exponentiation of the coefficient). Hosmer and Lemeshow (2000) simplify the discussion of the estimation and interpretation of odds ratios in MLR by generalizing the notation used in the binary outcome case to include the outcomes being compared as well as the values of the independent variables (factors). Hence, the odds ratio of $Y=j$ versus $Y=0$ (the reference outcome) for the independent variable's values of $x=a$ versus $x=b$ is

$$OR_j(a, b) = \frac{\frac{P(Y = j|x = a)}{P(Y = 0|x = a)}}{\frac{P(Y = j|x = b)}{P(Y = 0|x = b)}}$$

In this way, Hosmer and Lemeshow (2000:191) “use the more concise ‘relative risk’ type interpretation of the odds ratio”. This research will follow their practice and apply the same style of interpretation of the estimated odds ratios.

4.6.4.3 Model Building

In model building, the strategies suggested by Hosmer and Lemeshow (2000) are followed. Univariable analysis of each variable is the first step in model building, and it helps selecting the right variables in the model. For univariate analysis of nominal variables, Hosmer and Lemeshow (2000) suggest looking at the cross-tabulations of the dependent variable versus the independent variables.¹¹⁹

In variable selection, a combination of two approaches is employed in this research. Among the suggestions of Hosmer and Lemeshow (2000) and Tabatchnik and Fidell (2007) is the use of stepwise selection for variable selection as a useful and effective data analysis tool. Stepwise selection is one of the standard regression techniques used by MLR to select the variables that make the largest contribution to the prediction of the outcome variable in the final model (Petrucchi 2009). Whether variables are included or excluded in the model is solely based on statistical criteria. Hosmer and Lemeshow (2000: 96) state that “[t]he stepwise approach is useful and intuitively appealing in that it builds models in a sequential fashion and it allows for the examination of collection

¹¹⁹“The likelihood ratio chi-square test with $k-1$ degrees of freedom is exactly equal to the value of the likelihood ratio test for the significance of the coefficients for the $k-1$ design variables in a univariable logistic regression model that contains that single independent variable. Since Pearson chi-square test is asymptotically equivalent to the likelihood ratio chi-square test, it may also be used” (Hosmer and Lemeshow 2000: 92).

of models which might not otherwise have been examined”.¹²⁰ In this study I used the ‘backward elimination’ stepwise method, being fully aware of the fact that it is the author and not the computer who is ultimately responsible for the review and evaluation of the model built in this research.

Another approach to variable selection is the purposeful selection of scientifically relevant variables based on theory (called ‘forced entry’) (Hosmer and Lemeshow 2000, Petrucci 2009). It is not fully ignored, and employed to see the effect of a significant independent variable in the model when it did not meet the statistical criteria for inclusion into the model. The use of the stepwise method has been helpful in selection of the variables used in this approach.

4.6.4.5 Estimating the Learning Model

The learning model (LM) is built on the basis of learning in networks being influenced by selected network characteristics. In addition, ‘industry’ as a meso-level indicator of heterogeneity and ‘time period’ as an indicator of dynamic analysis are included in the LM. The magnitudes of β_{jk} ($k=1, \dots, K$) and ($j=1$) measure the learning effects in a relationship with respect to the eight variables of network characteristics that are expected to have effects on learning in networks. If, for instance, $\beta_{11} > 0$, then the ratio of the probability of learning from knowledge spillovers to the probability of no learning in a relationship would be higher for food-processing firms than for clothing firms.

The log odds-ratio (that is the logarithm of the ratio of the probability of outcome $Y=j$ to that of reference outcome $Y=0$) of the LM for assessing the effect of network characteristics on learning mechanisms external to the firm were specified in two sets. The first model looks solely at the main effects of networks characteristics. The second model looks at the effects of industry - interaction variables. They will be used in the econometric analyses in Chapter 7 and are as follows:

Learning Model

$$\begin{aligned} \log (\text{Prob}(\text{EXTLEARN}=j) / \text{Prob} (\text{EXTLEARN}=0)) &= \log (p_{ij} / p_{i0}) \\ &= \alpha_{j0} + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} + \beta_{jk} \text{Variables of Network Characteristics} \\ &\quad (k=1, \dots, K) \qquad \qquad \qquad \textbf{(LM)} \end{aligned}$$

¹²⁰ SPSS provides us with both forward selection with a test for backward elimination and backward elimination followed by a test for forward selection.

Industry - Interaction Model of Learning for industry differences

$$\begin{aligned} \log (\text{Prob}(\text{EXTLEARN}=j) / \text{Prob} (\text{EXTLEARN}=0)) &= \log (p_{ij} / p_{i0}) \\ &= \alpha_{j0} + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} + \beta_{jk} \text{Variables of Network Characteristics} \\ &+ \gamma_{jk} \text{Industry - Interaction variables} \quad (k=1, \dots, K) \end{aligned} \quad (\text{I/LM})$$

4.6.4.6 Estimating the Upgrading Models

Upgrading models (UMs) evaluate the contribution of learning in networks to various types of. In addition, ‘industry’ and ‘time period’ are included in the UMs, as a meso-level indicator of heterogeneity and an indicator of dynamic analysis, respectively. The magnitudes of the β_{jk} ($k=1, \dots, K$) and ($j=1$) measure the upgrading possibilities gained through a relationship with respect to a result of a particular type of learning in networks. If, for instance, $\beta_{13} > 0$, then the ratio of the probability of a contribution to managerial upgrading to the probability of no contribution to upgrading would be higher for learning by interacting than for no learning.

The log risk-ratio of the UMs for assessing the contribution of learning in networks to firm-level upgrading types was specified in four sets, and for assessing the effects of network alignment also in four sets. The first model looks solely at the main effects (contributions) of learning in networks. The second model investigates the additional contribution of internal factors complementary to learning in networks as *mediator*. The third model investigates the additional contribution of firm strategy. The fourth model looks at the effects of industry - interaction variables. They will be used in the econometric analyses in Chapter 8 and are as follows:

Upgrading Model 1

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE} =0)) &= \log (p_{ij} / p_{i0}) \\ &= \alpha_{j0} + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} + \beta_{j1}\text{EXTLEARN} \end{aligned} \quad (\text{UM.1})$$

Upgrading Model 2 (with complementary internal factors)

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE} =0)) &= \log (p_{ij} / p_{i0}) \\ &= \alpha_{j0} + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} + \beta_{j1}\text{EXTLEARN} + \beta_{j2} \text{INTLEARN} + \beta_{j3}\text{SHARING} \end{aligned} \quad (\text{UM.2})$$

Upgrading Model 3 (model with the effect of the variable ‘firm strategies’)

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE} =0)) &= \log (p_{ij} / p_{i0}) \\ &= \alpha_{j0} + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} + \beta_{j1}\text{EXTLEARN} + \beta_{j2} \text{INTLEARN} + \beta_{j3}\text{SHARING} \end{aligned}$$

$$+ \beta_{j4} \text{ STRATEGY} \quad (\text{UM.3})$$

Industry - Interaction Model of Upgrading for industry differences

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE}=0)) &= \log (p_{ij} / p_{i0}) \\ &= \alpha_{j0} + \theta_{j1} \text{INDUSTRY} + \theta_{j2} \text{PERIOD} + \beta_{j1} \text{EXTLEARN} + \beta_{j2} \text{INTLEARN} + \beta_{j3} \text{SHARING} + \\ &\beta_{j4} \text{STRATEGY} + \gamma_{jk} \text{ Interaction variables } (k=1, \dots, 5) \end{aligned} \quad (\text{I/UM.3})$$

4.7 CONCLUSION

This chapter has explained the research methodology used in this research in detail. First, it introduced the research model for the research questions examined. Second, it elaborated the research design by explaining the rationales followed during the sampling strategy, the sample of firms used in the analysis, data collection methods, the dataset created, and the unit of analysis of this research. Third, it justified the time periods used in this research in association with the GDP growth rates in Poland over the 1989-2001 period. Fourth, it introduced the key variables used in the analysis with their background in the literatures used in this thesis. Finally, it introduced the data analysis methods, their relevance and the models used in the analysis chapters 6, 7 and 8. Before turning to the analysis, the context of this research with regard to Polish economy and Science and Technology System will be discussed in the next chapter.

Chapter 5 AN OVERVIEW OF THE POLISH ECONOMY AND SCIENCE AND TECHNOLOGY SYSTEM

5.1 INTRODUCTION

This chapter presents the characteristics of the Polish economy during transition years and the associated network structure in Poland in the food-processing and clothing industries. It will also describe the S&T system in Poland in the light of main S&T indicators, innovation activities of Polish enterprises. The final section concludes.

5.2 STRUCTURE OF THE POLISH ECONOMY

This section will examine the structure of the Polish economy from 1989 to present, with some references to the 1980s. It will briefly introduce the Polish model of transition and then discuss the observed effects of liberalisation, stabilisation and privatisation policies implemented on the macroeconomic indicators of the Polish economy, its external trade relations, the development of privatisation process, foreign direct investment and enterprise restructuring in line with this model.

5.2.1 The Polish Model of Transition

Poland is considered as one of the most successful CEECs. Ever since the country emerged from its deep recession in 1992, she enjoyed a rapid economic growth with an average rate of 5% GDP growth per annum until 2001 (Gomulka, 2000) despite the 1998 financial crisis. After a slowdown of about two years in 2001 and 2002, the economy again grew at annual rate of around 5% until 2009. Essentially, the liberalisation, stabilisation and privatisation policies implemented in the first half of 1990s fostered the development of a well-functioning, competitive market economy through “a rapid expansion of the new private sector, a contraction and restructuring of the state sector, and a profound re-orientation and rapid growth of international trade” (Gomulka 2000: 19). Poland differed from other CEECs by following a complete liberalisation of prices, de novo private sector development and foreign trade, and a policy of gradual privatisation and macroeconomic stabilisation measures. In the second half of the transition period, reforms and policies in CEECs targeted promoting savings, including tax reforms intended to lower sharply both subsidies and direct taxes of companies and the difference in reforms and their impact on the economies narrowed

down particularly with external shocks in the form of international recession (Gomulka 2000). Compared to other CEECs, Poland's reforms were

“gradual in many important respects: it took 10 years to reduce inflation to below 1% a month, mass privatisation was limited mainly to small enterprises, social transfers have been large (pensions increased substantially in relation to wages) and budget deficits remained significant throughout the 1990s. The results of the programme were, on the positive side: the fast introduction of market prices based on relative scarcity and world prices for traded goods; a financial squeeze on SOEs, which forced them to release rapidly excess labour and physical capital (this is known as asset privatisation); the maintenance of a minimum tolerable level of effective corporate governance in SOEs (due in part to the workers' councils); and very rapid development of the de novo private sector. On the negative side, the restructuring of public services and public finances has been inadequate, limiting the growth of domestic savings and investments” (Gomulka 2000: 5).

5.2.2 Macroeconomic stability

The main characteristics of communist period in the late 1980s in Poland were stagnation in the economy with severe external debt burden and hyperinflation.¹²¹ In 1990-1991, the Polish economy experienced a deep slump. Practically non-existing unemployment started to increase over the early 1990s while employment declined by a cumulative 16% by 1994 (Table 5.1). In the mid-1990s, the economy experienced rapid output growth and low employment growth (except in 1996), while industry enjoyed large productivity gains (as a result of new capital equipment). According to EBRD data, share of industry in total employment was decreasing throughout the 1993-1998 period. Unemployment decreased to single digits for the first time in 1997, but this could not be sustained (Table 5.1, OECD 1998a). Current account deficit widened sharply and got worse after 1996. Although the inflation rate was declining since the early 1990s, it remained in double digits up until 2000, leading to cooling down policies after 1998.

¹²¹ GDP fell by 20.8% cumulatively between 1980-1982, while inflation rate amounted to over 100% in 1982 and current account balance approached 16% of GDP in 1980 and 1981 (Christofides 1994).

Table 5.1 Selected macroeconomic indicators of Poland, 1989-2008

POLAND	GDP (real percentage change)	Inflation (per cent, annual average)	General government balances (in percent of GDP)	Current account balance (in billions of US \$)	Exports of goods and services (percentage change in real terms)	Imports of goods and services (percentage change in real terms)	Gross fixed investment (percentage change in real terms)	External debt / GDP (per cent)	Employment (percentage change, end-year)	Unemployment (in percent of labour force, end-year)
1989	0.2	251.1	-7.4	1.8	2.6	4.3			-0.8	0.1
1990	-11.6	585.8	3.1	0.6	15.1	-10.2	-10.6		-7.2	6.3
1991	-7.0	70.3	-2.1	-2.0	-1.7	29.6	-4.4		-4.3	11.8
1992	2.6	43.0	-4.9	0.9	10.8	1.7	2.3	56.4	-2.8	14.3
1993	3.8	35.3	-2.4	-0.6	3.2	13.2	2.9	54.9	-1.7	16.4
1994	5.2	32.2	-2.2	6.8	13.1	11.3	9.2	47.1	1.1	16.0
1995	7.0	27.8	-3.1	5.3	23.6	24.3	16.9	38.0	0.3	14.9
1996	6.0	19.9	-3.3	-1.3	12.5	28.0	20.6	35.3	3.5	13.2
1997	6.8	14.9	-3.1	-4.3	9.9	16.7	21.9	36.6	1.3	8.6
1998	4.8	11.8	-3.2	-6.9	11.0	14.0	14.5	37.3	1.4	10.4
1999	4.1	7.3	-3.3	-11.6	1.0	6.0	5.0	42.2	-1.5	13.0
2000	4.0	10.1	-3.0	-10.0	17.5	12.0	4.9	42.4	-3.3	15.0
2001	1.0	5.5	-5.5	-7.2	8.0	7.0	-9.8	39.3	-3.1	17.4
2002	1.4	1.7	-6.7	-6.7	5.0	3.0	-5.8	44.7	-1.0	18.1
2003	3.9	0.8	-6.3	-5.5	14.2	9.6	-0.1	49.5	0.0	19.3
2004	5.3	3.5	-5.7	-10.1	14.0	15.8	6.4	51.4	2.5	18.0
2005	3.6	2.2	-4.3	-3.7	8.0	4.7	6.5	43.7	2.4	16.7
2006	6.2	1.2	-3.9	-9.4	14.6	17.3	14.9	49.7	3.6	12.2
2007	6.8	2.5	-1.9	na	9.1	13.6	17.6	54.8	4.2	8.5
2008	4.9	4.2	-3.9	na	7.2	8.3	8.1	46.2	3.0	6.7

Source: EBRD Transition Reports 1994, 1996, 1998, 2000, 2004, and <http://www.ebrd.com/country/sector/econo/stats/index.htm>

Poland experienced very slow growth (only 1% in 2001) and rising unemployment and current account deficit (over 10% levels) in the period 1998-2001. The recession between 1998 and 2001 appears in the statistics of gross fixed capital formation when it sharply fell by 9.8% in 2001 (Table 5.1). After 2002, Polish economy went through a strong recovery again; inflation not only fell considerably but also was sustained at single digits' moreover, "consistent employment growth since 2004 reflects improving optimism among firms, who may therefore be more likely to expand capacity" (OECD 2006: 23) and although unemployment levels remained high, they were declining after peaking at 19.3% in 2003. In 2006-2007, Poland had its strongest economic performance since the mid-1990s, with growth exceeding 6%, led by increase in gross fixed capital formation (OECD 2008, Table 5.2).

Throughout the period 1989-1999, despite a wide range in its fluctuation from -24.2% to 12.1%, growth rates of industrial output were in close harmony with the GDP growth rates, just like in the old communist days (Dyker 2004).¹²² Industry had initially represented around 40% of GDP, which declined steadily over the years to around 30% level, and dramatically regressed to 25% in 2008.

¹²² The decline of industries in terms of industrial output growth commenced in the 1980s in most of the CEECs, with exception of one or two industries in each country and Poland was the least affected due to its massive borrowing and vast input of investment capital in a way to characterise the 1970s until the transformation has started (Fay 1991). However, in the early years of transformation in Poland "official statistics depict a steep production decline in all industrial branches" (Slay 1994: 138, also Table 5.1).

Table 5.2 Sectoral structure of Polish Economy, 1989-2008

POLAND	industrial gross output (% change)	agricultural gross output (% change)	share of industry in GDP (per cent)	share of agriculture in GDP (per cent)
1989	na	na	44.1	11.8
1990	-24.2	-2.2	44.9	7.4
1991	-8	-1.6	40.2	6.8
1992	2.8	-12.7	34	6.7
1993	6.4	6.8	32.9	6.6
1994	12	-9.3	32.2	6.2
1995	9.6	10.7	29.2	6.4
1996	8.3	0.7	27.1	6
1997	11.5	1	28.1	5.7
1998	4.8	1	28.1	5.5
1999	4.4	-2	28.2	5.2
2000	7.1	0	29	5
2001	-0.5	2	28.6	5
2002	2	3	29	5
2003	5.9	2.7	29.2	4.4
2004	9.1	6.9	30.8	5.1
2005	4.4	-1.0	30.7	4.5
2006	11.6	-2.2	31.3	4.3
2007	11.3	-3.4	26.3	4.3
2008	na	na	25.4	4.5

Source: EBRD Transition Reports 1994, 1996, 1998, 2000, 2004,
and <http://www.ebrd.com/country/sector/econo/stats/index.htm>

5.2.3 Trade liberalisation

In the early years of transition, Poland made significant efforts to integrate itself into the world trade. It immediately started to liberalise its foreign trade regime by abolishing the state monopoly and administrative management of foreign trade through Foreign Trade Organisations (FTOs), by abolishing quantitative import restrictions in manufacturing, by reducing average tariff levels and by using customs duties as the main trade policy instrument (Mylonas 1994, Slay 1994). The introduction of convertibility in domestic currency for current account transactions and devaluation of the national currency¹²³ created a strong stimulus to the exports activities of firms. By shifting its trade to non-CMEA countries and its exports from machinery and equipment sale (the most single contributor to export revenues, fell from 30% in 1988 to 17% in 1991) to metal products, processed food and apparel (UNECE 1993), Poland quickly improved its trade performance (Table 5.3).¹²⁴

¹²³ Zloty devalued 16% in May 1991, 11% in Feb 1992 and 8% in August 1993.

¹²⁴ By 1993, trade with the West accounted for three-quarters of Polish trade while trade with CMEA declined sharply to one-seventh in 1995. "By 1995, trade with EU countries represented some 70% of exports and 65% of imports" (OECD 1996-97: 19). Also by 1995, exports to developed countries showed a shift towards lighter manufactures while food-processing and live animals had an increasing share in exports to CMEA countries, perhaps reflecting fewer trade restrictions (IMF 1997: 193). "The share of exports intensive in low-skill labor rose by some 10 percentage points, consistent with the increasing importance of outward processing. In 1995, share of outward processing reached 24 % for exports and 12% for imports (in light industry, 82 and 62% respectively)" (OECD 1997: 63 and 19).

Table 5.3 External Trade relations of Poland, 1990-2008

	Trade balance (US \$ mn)	Merchandise export (US \$ mn)	Merchandise imports (US \$ mn)	Share of trade in GDP (in %)	% of Food and beverages industry in manufacturing		% of Wearing apparel industry in manufacturing	
					exports	imports	exports	imports
1989					14.1	13.2	8.1	10.6
1990	2,200	10,900	8,600		15.3	11.5	9.7	9.0
1991	100	12,800	12,700	32.7	16.6	14.8	10.2	8.6
1992	500	14,000	13,500	32.6	15.0	11.9	13.0	6.2
1993	-2,482	13,598	16,080	34.5	12.7	10.2	21.4	13.3
1994	-895	17,024	17,919	37.7	13.2	10.0	20.1	13.6
1995	-1,912	22,878	24,790	40	11.2	8.7	18.6	12.7
1996	-8,179	24,453	32,632	42.4	12.1	8.5	17.6	10.9
1997	-11,320	27,229	38,549	48.5	14.3	7.5	16.3	9.8
1998	-13,720	30,122	43,842	47	11.3	6.6	15.4	9.6
1999	-14,380	26,347	40,727	43.6	9.6	6.0	14.9	9.2
2000	-13,145	28,277	41,422		5.9	7.0	6.9	4.9
2001	-13,500	31,500	45,000		6.0	7.2	6.1	4.7
2002	-10,352	32,945	43,297		6.0	7.3	5.2	4.3
2003	-5,725	61,007	66,732	58.9	6.4	7.3	4.3	3.8
2004	-5,622	81,862	87,484	66.9	6.9	7.2	3.0	2.9
2005	-2,766	96,395	99,161	64.3	7.9	7.7	2.4	2.3
2006	-7,006	117,468	124,474	70.8	7.9	7.4	1.8	1.8
2007	-17,057	145,337	162,394	72.4	8.0	8.0	1.5	1.4
2008	-23,228	178,427	201,655	72.0	8.4	8.5	1.2	0.9

Source: Own calculations based on data from EBRD Transition Reports 1996, 1998 and 2000, Rapacki (2001:131), selected Statistical Yearbook of Industry of Polish Central Statistical Office (GUS), and <http://www.ebrd.com/country/sector/econo/stats/index.htm>.

The EU quickly became Poland's largest trade partner with almost 60% of total exports and imports both; half of it this was trade with Germany, which became the main engine of Polish trade growth (Mylonas 1994, Kaminski 1993) and "remained by far the largest trading partner, absorbing some 38% of exports and accounting for 27% of imports" by 1995 (OECD 1997: 19).¹²⁵

Pickles *et al.* (2006: 2310, source: Eurostat, 2001) report that the proportion of total Polish clothing exports to the EU among the top 20 apparel exporters to the EU was 39.6% in 1990 and 46.4% in 2000. Food-processing, on the contrary experienced a sudden growth of imports which was resulted from the growth of FDI as well as induced direct competition against domestic producers (Blanke-Lawniczak 2009).

There were a number of setbacks to food-processing exports due to quota restrictions in many preferences that the EU granted to Poland and the development of international

¹²⁵ EU contributed to this development by opening its markets first through a bilateral trade and cooperation agreement in 1989 that phased out/eliminated all selective quantitative restrictions over a ten year period and granted a Most-Favored Nation status alongside Generalized System of Preferences treatment for some goods, and then through with Association agreements in 1991 to facilitate its economic integration with the EU with regard to movement of capital and labor, competition rules, harmonization of economic and financial laws to the community legislation (Mylonas 1994). Yet still there were barriers to Polish exports in some agricultural products such as fruit and vegetables as well as meat products sector. Some categories of textile products also faced quotas. In return, Poland introduced a more protective trade regime, particularly in agriculture. While tariffs and quotas fell for industrial products, they increased for agricultural products (Mylonas 1994).

trade that included customs union, export licenses, technical barriers to trade, veterinary and sanitary restrictions and export duties (Blanke-Lawniczak 2009, Szymanski *et al.* 2007 and own interviews).

As shown in Table 5.3, although the share of foreign trade in GDP increased significantly from 32.6% in 1992 to 48.5% in 1997, the trade deficit widened sharply from 1996 onwards.¹²⁶ The period covering late 1990s and early 2000s was significantly influenced by the Russian financial crisis of August 1998 and the economic slowdown in the EU during the winter 1998-99, most notably in Germany, which adversely affected exports (particularly in the clothing industry, see Table 5.3) as well as business and consumer confidence. The overall macroeconomic environment was not favourable in this period; however, food-processing exports rose between 1996 and 2002 while imports increased gradually, and trade surplus was achieved in 2003 (Blanke-Lawniczak 2009).

5.2.4 Privatisation

As discussed above, Poland has been a leader in economic performance, yet rather a gradualist in privatisation with a deep programme (Kozarzewski and Woodward 2006, Kochanowicz *et al.* 2005).¹²⁷ In fact, Poland had started to ease limitations on private enterprises and the formation of private joint stock companies during through the end of the communist regime in the 1980s, hence the name ‘market socialism’ in Poland. Moreover, the Polish economy was not concentrated and Polish agriculture not as collectivised as in other communist countries (Schaffer 1992, Slay 1994).¹²⁸

¹²⁶“The slowdown in exports in 1996 was partly the lagged effect of the marked appreciation of the real exchange rate in the course of 1995. It also resulted from the slowdown in demand in the EU (which absorbs almost two thirds of Poland’s exports), especially in Germany (whose share in Poland’s exports dropped from 38 per cent in 1995 to 33% in 1997)” (OECD 1998a: 20).

¹²⁷ Between 1990 and 2007, 7364 SOEs were included in the privatisation process, which accounted for 82.4% of the total number of SOEs registered at the end of 2007. 1608 of them were transformed into sole-shareholder companies of the State Treasury (a process referred to in Poland as “commercialization”); of these manufacturing companies privatised by indirect method were 302 and by NIF program were 367. 2174 of them included in direct privatisation but 2089 of them completed (of which manufacturing companies were 757). Out of 1914 companies that were subject to liquidation, 1044 of them liquidated. And finally 1654 of them were incorporated into Agricultural Property Stock of the State Treasury (from 1992 to 1995) (Statistical Yearbook of Poland 2007). The pace of privatisation has always remained slow with still over a thousand SOEs to be privatised (OECD 2004, 2008), but the revenues from privatisation increased cumulatively from 12.4% in 2003 to 14.2% in 2007.

¹²⁸ 80% of land was in private hands and private agriculture contributed to some 11% of GDP in 1989 (Rapacki 2001). Yet, the public sector accounted for around 70% of GDP in 1989 and 1990. Throughout the transition years, despite a slight decrease in the share of agriculture in GDP, the share of private sector in agricultural employment has steadily been one fourth of total employment (Table 5.1).

As opposed to other CEECs, Poland prioritised macroeconomic measures over privatisation and restructuring reforms; even when the economy recovered, Poland has been ‘careful’ about corporate governance and relied more on case-by-case privatisation (Dyker 2004, Anderson *et al.* 1997), which coupled with measures like imposing hard budget constraints, promoting restructuring of SOEs, and creating institutions of corporate governance, contributed to private sector development and increasing productivity of the enterprise sector (Kochanowicz *et al.* 2005).

Ownership transformation in Poland took two forms: One is the top-down government-led privatisation through which existing assets/organisations were transferred from state to private ownership, and the other is bottom-up development of private sector through establishment of new firms. Although the dynamics of ownership structure relied more on bottom-up privatisation than top-down (Błaszczuk 1999),¹²⁹ the sample of firms in this research consists of large enterprises with over 500 employees which were state-owned and were either privatised or in the process of privatisation (i.e. commercialised¹³⁰ but not yet privatised) at the time of the interviews. So, the results of this research with regard to any privatisation impact refer to top-down privatisation. Food-processing firms in this research’s sample were privatised through direct sales of shares (to foreign or domestic strategic investors or public share offering) and clothing firms were privatised through voucher privatisation (the National Investment Fund, or NIF, programme). The former “proved to be most successful in terms of completed privatisation, reliable corporate governance and good economic performance”; while “[t]he performance of the enterprises following voucher privatisation (NIF) track has systematically worsened. Commercialized companies still under state ownership also have not performed well and are in critical need of restructuring” (Błaszczuk 1999). For food-processing firms, privatisation meant more than for clothing firms (section 4.3.1.2). Some authors viewed privatisation as opportunities for positive externalities

¹²⁹ In the early years of transition, the vast majority of SOEs were liquidated rather than sold more because of bankruptcy than voluntary liquidation for the reasons of persistent recession, national currency zloty’s appreciation, loss of CMEA markets, stiffer application of environmental regulation and fines and growth in real wages (Slay 1994). Therefore, the entry of new private firms contributed to the development of private sector more than government-led sale of SOEs.

¹³⁰ Commercialization or corporatization of SOEs (i.e. transformation of SOEs into wholly-state-owned joint stock or limited companies) “intended to improve the performance of enterprises by installing supervisory boards on which the Treasury is represented to provide checks and balances to management/workers’ councils and thereby improve corporate governance” (Christofides 1994: 63). Some effects of commercialization are captured in a study by Pinto *et al.* (1992).

through foreign strategic investors and some as invasion of FDI. Both industries were susceptible to SME development that largely replaced SOEs (section 4.3.1.3).¹³¹ In any case, by 2000, state entirely disengaged from a few sectors, one of which was meat processing.

Table 5.4 Privatisation, FDI and Enterprise restructuring, 1989-2007

	Privatization			FDI	Enterprise Restructuring			
	Private sector share of GDP (%)	Private sector share in total employment (annual averages, %)	Privatization revenues (cumulative, in percent of GDP)		Investment rate (in % of GDP)	Share of industry in total employment (%)	Industrial labour productivity** (annual % change)	Change in labour productivity in industry (%)
1989	28.6			na				
1990	30			0				
1991	40		0.2	117	18.5	27.5	-4.2	0
1992	45		0.4	284	15.8	25.9	16.6	12.5
1993	50	56.9	0.9	580	14.9	24.6	9.7	13.8
1994	55	59.4	1.7	542	18	22.5	12.8	13
1995	60	61.9	2.6	1134	18.7	23.1	6	6.5
1996	60	64.1	3.6	4,445	20.9	22.2	9.1	9.1
1997	65	68.8	5.1	4,863	23.6	21.9	11.2	11.6
1998	65	70.8	6.4	6,049	25.3	21.7	4.6	4.3
1999	65	71.4	7.7	7,239	na	21.1	9.6	9.1
2003	75.0	68.5	12.4	4,284	18.7	28.4	13.5	7.1
2004	75.0	70.3	13.5	11,761	20.1	28.3	6.4	7.0
2005	75.0	70.5	13.9	6,951	19.3	28.7		0.6
2006	75.0	71.0	14.0	10,727	21.1	29.3		5.3
2007	75.0	73.3	14.2	17,987	24.3	30.1		4.0
* net flows recorded in the balance of payments								
** defined as gross industrial product per person employed in industry								
Source: EBRD Transition Reports 1996,1998 and 2000, Dyker (2004: 301 and 305); IMF Staff Country Reports, Republic of Poland, No.00/61(2000) and No.02/128 (2002); and http://www.ebrd.com/country/sector/econo/stats/index.htm								

5.2.5 Attracting Foreign Direct Investment (FDI) and its spillovers effects

During socialist era, Poland was the only country among CEECs that allowed wholly foreign-owned undertakings (the others were limiting it to 49% ownership).¹³² The liberalisation of FDI came in July 1991; however, its record was lagging behind other CEECs (OECD 1998a). According to a survey conducted by PAIZ¹³³ in 1993, the reasons for FDI to be attracted to Poland were low labour costs and the large domestic market. 50% of the enterprises with foreign participation were involved in export activities, and 20% of them were export-oriented (Mylonas 1994). However, despite

¹³¹ Blanke-Lawniczak (2009) states that the mid-size enterprises accounted for 12% of all businesses in 1992 which increased to 24% by 1998, suggesting an increase in the share of Polish enterprises in the food-processing market, since the majority of FDI was done by large enterprises.

¹³² “[A]s of 1989, there were 695 companies in Poland with Western participation, by far the most of any East European nation” (Haug 1992: 236-7)

¹³³ Abbreviation for Polish State Foreign Investment Agency.

substantial levels of FDI inflows, since 2000 they have been still lower than in other CEECs.¹³⁴

The modest levels of FDI in the early 1990s were soon surpassed (Table 5.4), indicating growing investor confidence, which was particularly boosted through implementation of important structural reforms and fast pace of privatisation in 1998-1999. By the end of 2001, the food-processing industry alone received nearly \$3billion, making Polish food-processing industry the single largest attractor of FDI in CEE (Szymanski *et al.* 2007, Jensen 2004, PAIZ 2001, OECD 2000, Haudeville *et al.* 2002).¹³⁵ The influx of FDI has been mostly in high value added sub-sectors of the food-processing industry such as confectionery, soft drinks and alcoholic beverages (Szymanski *et al.* 2007), and MNCs have been using Poland as hub for their exports to other CEECs and former Soviet Union countries.¹³⁶ In the clothing industry, as mentioned earlier (section 4.3), FDI was limited, and the subsidiaries of big textiles and clothing MNCs were functioning not for the domestic market but for the home country and its export markets.

There is a large literature on spillovers from FDI to domestic CEE firms predicting that FDI would induce the modernisation of the domestic firms by forcing them to keep pace with the competition imposed by the presence of foreign firms, to improve their innovative efforts and catch-up with the EU. This literature examines these effects using productivity measures as a proxy for spillovers during transition years (as mentioned in section 3.4.1). Weresa (2004) found that this is true except for low-technology industries. In the context of CEECs, a review of this literature is made by Günter (2005), who concludes that there is not only lack of evidence for positive spillover effects on domestic firms but also lack of explanation of the reasons why. She asserts that this is due to lack of consistent theoretical framework about spillover mechanisms.

¹³⁴ FDI have averaged 3.5% of GDP in Poland between 2000-2006 compared with 5% in Hungary and over 7% in the Czech and Slovak Republics (OECD 2008). In 2001, net FDI inflow was 3.2% of GDP, way behind Estonia (9.7%), Czech Republic (8.7%) and Slovakia (6.3%) (Commission of the European Communities, 2003: 11).

¹³⁵ As early as 1993, inward FDI in food-processing industry reached USD 426million and it grew sixfold from 1994 (USD 717.3million) to 1998 (USD 4,460.7million) (Blanke-Lawniczak 2009: 139). By the end of 1998, food-processing products, beverages and tobacco sector received almost 4.5 billion USD FDI stock with almost 1.5 billion USD investment plans. This corresponded to 14.6% of total stock of FDI.

¹³⁶ Among the top 50 major foreign investors, there were five food-processing and two brewing investors. These were Coca Cola (GB), Nestle (Switzerland), Pepsi Co. (USA), Mars Incorp. (USA), Cadbury Sweppes (GB), Harbin BV (Netherlands) and Heineken (Netherlands).

The results of FDI spillovers research on Poland are quite controversial. Zukowska-Gagelmann (2000) finds negative productivity spillover effects of FDI especially in Polish private firms in highly competitive sectors of manufacturing industry in the period 1993-1997. Jensen (2004) also finds negative spillover effects of FDI specifically on Polish food-processing industry in the period 1993-2000. Damijan *et al.* (2003), however, find positive spillover effects for both vertical and horizontal spillovers from FDI in Polish manufacturing industry in general during 1995-1999 period. Given the expectations of positive spillover effects, negative or non-positive results were suspected to result from the choice of methodology and the measures used (Günter 2005).

There is a largely overlooked issue in the spillovers literature that might have had an impact on these mixed results in the earlier empirical studies. It is only relatively recently that the literature on FDI spillovers has taken explicit account of the need of firms and host countries for ‘absorptive capacity’ to benefit from the spillovers from FDI. A recent review of FDI spillover literature by Rojec and Knell (2012) details not only the results of these empirical studies but also the measures used for absorptive capacity in spillover analysis. Absorptive capacity is introduced to the empirical studies of FDI spillovers through examination of firm heterogeneity and host country specificities (Rojec and Knell 2012). By disaggregating the data into more homogeneous groups of firms, these studies examine *foreign investors’* heterogeneity (e.g., differences in spillovers can be identified according to the home country of foreign investors), *foreign subsidiaries’* heterogeneity (e.g., the position of a subsidiary in the foreign parent company’s network / value chain, the domestic versus export market orientation of a subsidiary, acquisition versus greenfield type of FDI, and joint ventures versus wholly foreign owned subsidiaries), and *domestic firms’* heterogeneity (e.g., their productivity, technological capacity, export propensity, and human capital). The same review details the measures for host country specificities as: overall level of development, level of human capital, cluster development, investment and business climate, level of infrastructure and the size of the host country. Most importantly, using these measures, Damijan *et al.* (2013) not only found that horizontal spillovers have become increasingly important over the last decade, exceeding the importance of vertical spillovers, but also that FDI spillovers depend on the absorptive capacity and productivity level of individual firms.

In the words of Rojec and Knell (2012:16), the main issue for the recent spillover analysis

“is the failure to better understand and to identify the exact mechanisms through which FDI facilitates knowledge spillovers (Griffith, Redding and Simpson, 2004: 16-19). Much work remains to be done until the precise process of spilling-over will be described correctly; the exact channels of embodied and disembodied spillovers remain undetermined (Hoppe, 2005: 40-42). Ornaghi (2004: 26-27) also claim that further work is needed to determine the channels that actually permit knowledge to flow and how these differ between product and process innovations”.

5.2.6 Enterprise restructuring

Historically in socialist countries, LMT industries were dominated by the political hierarchies that favoured supply and self-sufficiency policies. Priority and subsidies were given to production of basic consumer products, but not to a level of processing that would differentiate products in the market, to packaging for marketing purposes, to distribution (run by the state), and to quality (kept at an inferior level) (von Tunzelmann and Yoruk 2004). In addition, as opposed to firms in market economies, centrally planned economy firms with soft budget constraints were bailed out of their financial difficulties and never felt the pressure of competition (cf. Kornai 1995).¹³⁷ Moreover, their technological level mostly depended upon CMEA countries in terms of availability and standard of physical capital. Therefore, when the system collapsed in 1991, both the food-processing and clothing industries were underdeveloped, with an enormous need for investments to update the obsolete machinery and equipment as well as to catch up with European standards (Zacher 1997). Under these circumstances, both industries faced a severe crisis after the transition. Worst of all, these industries were sacrificed in favour of the expansion of other industries, such as heavy industry and extractive industries, so the firms, with dearth of capital and facing hard-budget constraints for the first time, were left alone to replace the deficiency of strong CMEA solidarity.

Industrial restructuring in Poland represented a recovery in traditional low-to medium-skill sectors as well as development of a new services sector, with persistent obstacles to a well-functioning market, both at the wholesale and retail levels (Dyker 2004, OECD 2008). However, it led to strong productivity gains throughout the transition

¹³⁷ In order not to cease to exist, firms in market economies with hard budget constraints have to keep abreast with best-practice technology as a matter of long-term survival.

years, with industrial productivity growth averaging around 11% during 1991-2001 (Table 5.4). The high levels of change in labour productivity in industry slowed down in the late 2000s. Although the share of industry in total employment declined in the mid-1990s, it accelerated to around 30% in the late 2000s, and the investment rate has been around one fifth to one fourth of GDP during 1991-2007.

Surpassing the pre-transition levels of output as early as 1992 led particularly Polish manufacturing industry to deeper restructuring at the enterprise level during 1993-1999, especially by a jump in FDI inflows after 1995 (Carlin and Landesmann 1997). In this period, the role of foreign and/or domestic strategic investors with long-term strategic interests in enterprise restructuring in central Europe has become a dominant pattern, as they brought industrial and managerial expertise, finance for upgrading product quality and production processes and reducing costs, and alignment of ownership, control and vested interests in favour of profit incentives within the firm (EBRD 1999, Carlin and Landesmann 1997, Djankov and Murrell 2000, Anderson *et al.* 1997). In particular the presence of FDI “accelerated food-processing industry reforms, improved absorptive and production capacities in domestic food-processing industry segments characterised by high added value, and brought substantial know-how into the sector in marketing, finance and quality, risk and resource management, which in turn provided an impetus to the development of the human capital in areas that had thus far been weak among domestic enterprises” (Blanke-Lawniczak 2009:140). In other words, this role for substituting the deficiencies in the Polish NSI has been played by FDI in the food-processing industry and by global buyers in GVCs/GPNs in the clothing industry. Hence, spillover effects of FDI and foreign partners on Polish firm’s upgrading in both of the industries are worth examining from another viewpoint, that of networks.

5.3 SCIENCE AND TECHNOLOGY IN POLAND

In this section, after a brief introduction of the institutions of S&T system in Poland during the pre- and post-communist times, the main S&T indicators and the innovative enterprises will be examined with special references to food-processing and clothing industries.

5.3.1 Science and Technology System in Poland

In the socialist period, Poland, like other CEECs, experienced top-down S&T policies. It is widely accepted today that as opposed to the market economies where R&D is financed and executed by business organisations S&T system under communism followed a linear innovation model which separated technological competencies from firms, condemning them to be passive actors (Hanson and Pavitt 1987, Pavitt 1997, Dyker 1998, 2004d, Chataway 1999, Jasinski 1997, Radošević 1997, 1998, 1999b). These competencies were established in three types of institutions, which were *universities* for education and some individual-based research, *academies of sciences* for basic research, and *branch research institutes and design bureaux* for practical applications and problem solving activities in industry (Freeman 1995; Chataway 1999). Hence, NIS was state-dominated, and R&D was financed by the state and executed in the laboratories and institutes for the state. Under this S&T system, not only were these technological competencies more obsolete than it was thought in comparison with international best practice (Hanson and Pavitt 1987), but also R&D activity, which yielded technology, was seen as an easily transferable, freely available information-like commodity that was administered by the state. As a result, while the level of resource allocation especially to research, development and other innovative activities under communism was fairly high, in practice basic and applied research (in the Western sense) were divorced from each other and from the production processes (Dyker 2004b, von Tunzelmann and Yoruk 2004). This disconnect shaped the interactions between public organisations and firms that evolved during the transition, and the pace of formation of NIS.

During 1990s, R&D institutions in Poland contracted dramatically¹³⁸ and the surviving ones faced deep cuts in their budgets.¹³⁹ Arm's length contractual relations started to

¹³⁸ During 1989-1992, 15% of industrial R&D institutes were closed and 22% of the workforce lost their jobs (Chataway 1999). As reported by Dyker (2010), though significantly inefficient with a lack of systemic integration into the innovation activities of private firms, Poland still has 190 branch research institutes (relatively high number compared to other transition countries) which continued to receive financial support from the government.

¹³⁹ Pavitt (1997) takes our attention to the potential dangers behind the squeeze on public funding to these institutions. Such financial dire straits led these institutions to do basic research only to fulfil R&D contracts for private firms in order to raise funds through short-term contract research. Pavitt emphasises that the basic researchers should be encouraged to pursue the most challenging problems within broadly defined fields and not be diverted from these objectives for the sake of financial concerns. These concerns may underlie the situation of the Polish industrial R&D institutes and their isolation from the S&T community (based on my interviews, see discussion below).

shape the link between R&D institutions and firms.¹⁴⁰ But the mismatch between the skills and styles of work of the R&D institutions and the needs and priorities of the industry (Zacher 1997, Chataway 1999, Pavitt 1997) left firms dissatisfied (based on my interviews) and therefore industrial demand for R&D fell (Dyker 2004a). Gradually, this led to the shift in the role of innovation organiser from state R&D institutions to firm-level cooperation (Bitzer 2000, Radošević 2002, 2004). Cooperation with technical universities in Poland in the area of R&D has been a tradition (Dyker 2010); however, it reduced significantly possibly due to low effectiveness in path-breaking innovation. Nevertheless, as in the socialist times, the focus of S&T system in the 1990s was still on science (i.e. basic) rather than on technology and product development (i.e. applied science), and there was no S&T policy that prioritised strengthening financial and institutional conditions for technology transfer, innovation and knowledge diffusion through a systematic coordination among the agents at national level to improve the competitiveness of domestic firms (Pavitt 1997, Radošević 1999b, 2002, Bitzer 2000, Jasinski 2003, Dyker 2004). The importance to restructuring of S&T systems including implementation of abovementioned policies has been widely ignored by post-socialist countries.

By the end of 1990s, in Poland, many public R&D institutes were losing interest in basic research because of their difficulties in raising funding for it. However, they also showed a surprising ability to establish networks with domestic and foreign research actors. The institutes were receiving declining amounts of money from the government, and unless it was obligatory by the state, the firms had no interest in engaging in collaborative research with the domestic public research institutes. Instead, the most capable institutes were getting involved in EU framework projects alongside European partners (Box 1) or starting to function like independent firms by producing and commercialising niche products derived from their own basic research (Box 2). They constituted good examples for the weakening linkages between the institutes and the firms in the national sphere (Blanchard and Kremer 1997, Radošević 1998, 1999b). Von Tunzelmann (2004, 2010a) calls it ‘network failure’ where a dramatic structural shift from centrally-planned national networks of the communist era (which shaped the interrelations between actors in the national system rather inefficiently with regard to

¹⁴⁰ In a way, this was repeating old habits or proving path-dependency, because, according to Contractor and Sagafi-Nejad (1981:120), “in the socialist nations, licensing [was] often the only mode of transfer (Hayden 1976, Business International 1972)”.

technological resource flows to align technology with production processes and products) to the dominance of global networks. In other words, another network misalignment was starting to take place, characterised by the weakness of national and local networks in the form of cooperation among firms and between firms and the industrial research institutes.

Box 1. The case of a public research institute in the food industry: IHAR in Jadwisin

Example 1 was a public research institute called IHAR in Poland, which was in charge of breeding new varieties of agricultural seeds during the communist period and the only institute to register new seed varieties. With the changing research environment for the institute researchers, the management of IHAR in Jadwisin (the potato breeding branch of IHAR, based on my interview with the manager and three researchers in the institute in May 2001) replaced the state subsidies with a number of projects financed by the UK and the EU. However, they were still striving to change their image in the domestic business environment in order to end the divorce between production and technology. At the time of interview in 2001, they had started to give priority to marketing themselves as consultants to firms in order to initiate knowledge diffusion mechanisms between the institute and the firms, and the number of domestic firms that were willing to cooperate with IHAR in Jadwisin was gradually growing. This example of the Polish branch R&D unit specialized in the food-processing industry substantiates the fragmentation among the Polish R&D organizations, especially other IHARs that are specialized in seed breeding, since it has no links and efforts to develop links with them. It has a strong tendency to get closer to foreign R&D organizations, which suggests neither fragmentation nor duplication of R&D efforts that takes place in the EU, but rather a role played by the institute as a cooperating partner for the development of knowledge.

The Plant Breeding and Acclimatization Institute (IHAR) - National Research Institute is the largest Polish research centre in the multi-disciplinary area of crop improvement, biotechnology, germplasm conservation and enhancement. IHAR was founded in 1951 for research in breeding and seed production of major field crops. (<http://www.ihar.edu.pl/en/>, accessed in August 2011).

Source: Own interview in 2001

Despite its quick recovery in macroeconomic indicators, Poland could not transform its S&T system from the domination of Academy of Sciences and restructure its R&D despite the help of highly dynamic business sector that financially significantly supported traditional R&D structures (Dyker 2004c). Its reform constituted of change in the institutional structure of funding through one body: The Committee for Scientific Research (KBN) (Chataway 1999, Kozłowski 1998, 2004). After the transformation, with the gradual evolution of the enterprises through restructuring, privatisation, and corporate governance, a bottom-up system was initiated / encouraged to emerge. The existing NIS, which was predominantly state-dominated, has shown signs of conversion into a market-oriented one. While doing so, Pavitt (1997) stresses the importance of efficient innovation *and* imitation through accumulated competencies, which depends

not only on private initiative but also public policies, like in Western experience. Part of the network misalignment in transition economies (as developed by Von Tunzelmann (2004, 2010a)) is also a result of state withdrawal over market forces in the strategic issues such as S&T policies, or worse, of the weak governments that were faced with large co-ordination problems when pursuing a variety of conflicting objectives (Radošević 1998, 2002).

Box 2. The case of a public research institute in the textiles and clothing industry: Institute of Natural Fibres in Poznan

Example 2 is Insitute of Natural Fibres in Poznan. What is remarkable about this state-owned industrial research institute is its success in commercializing many of its patents in many areas, especially in clothing and food supplements. Like many other Polish R&D institutes, it also realizes significant revenue streams from provision of services. In the communist era, the institute was actively inventing products for a variety of industries, but they were not commercialized (e.g., linen socks with good absorption capacity were invented 30 years ago). The institute had to wait until ten years ago to become innovative in the market. In the early 1990s with the transition, the institute began to sell products that were invented by the staff (the abovementioned socks were the first product in the market) and as a result, by 2004, 60% of the institute's budget came from other sources than the state. The institute has gone through a transformation that was a 'must' to survive under changing conditions: It has established a new division that deals with marketing and distribution of the products in five shops in four cities and developed distribution network in cooperation with two clothing producers. By 2005, around 300 products that are more or less 50-50% own production and licensed production were marketed. In contrast to many research institutes in the transition period, the institute's scientific research has not halted with this transformation, but rather gained momentum in related areas. For example, they conduct research on clothing as a health factor (they have proven that polyester clothing increases the level of histamines in blood, while linen clothing reduces it), as well as on food and cosmetic products made from natural fibers. One of their food products is linseed oil, and they also make polymethane from linseed oil (it is worth noting that after an initial decline in flax production at the beginning of the transformation, more and more of the institute's linseed input is domestic). In cosmetics, a well-known Polish cosmetics company uses the institute's linseed oil for its products.

Extracted from Woodward, *et al.* (2010), where I conducted the interviews together with the first author and wrote the case studies.

Source: Own interview in 2004 and 2005

5.3.2 Main S&T indicators

Poland appears to have not only very low investment in R&D compared with the EU-25 (1.83% of GDP in 2002) but also predominance of public funding for R&D, as compared to the Western countries. During the first ten years of transition, gross

expenditures on R&D (GERD) grew more slowly than GDP and in fact fell (Table 5.5). More than half of GERD is financed by the government since the mid-1990s (Jasinski 2003, Dyker 2004c, 2010), with one third of the contribution by a dynamic business sector in Poland. As mentioned above, due to little radical restructuring in R&D, compared to other CEECs, R&D in Poland is underfinanced and therefore underperforms (Dyker 2004, OECD 2004, 2007). However, this is compatible with Poland's manufacturing exports, whose more than half of it concentrated on low and medium-tech products (OECD 2007, section 5.2.4).

Table 5.5 Gross Expenditure on R&D and Business Enterprise R&D Expenditures, 1980-2007

	GERD by sector of performance (% of GDP)					GERD by source of funds (%)					BERD (%)				
	GERD/GDP	business enterprise sector	government sector	higher education sector	private non-profit sector	business enterprise sector	government sector	higher education sector	private non-profit sector	abroad	BERD/GDP	manufacturing in all sectors	food processing in all sectors	food processing in manufacturing	wearing apparel in all sectors
1980	1.52														
1985	0.88														
1990	0.96														
1994						39.5	57.3	1.5	0.4	1.3	0.32	71.9	1.3	1.8	0.0
1995	0.63	0.25	0.22	0.17	0	36.0	60.2	1.7	0.4	1.7	0.25	73.9	1.1	1.5	0.0
1996	0.65	0.27	0.2	0.18	0	38.9	57.8	1.6	0.3	1.4	0.27	71.1	1.0	1.5	0.2
1997	0.65	0.26	0.21	0.19	0	35.1	61.7	1.3	0.3	1.6	0.26	73.2	2.2	3.0	0.0
1998	0.67	0.28	0.21	0.18	0	37.8	59	1.3	0.3	1.5	0.28	76.9	1.5	1.9	0.0
1999	0.69	0.29	0.21	0.19	0	38.1	58.5	1.4	0.3	1.7	0.29	76.5	1.4	1.8	0.0
2000	0.64	0.23	0.21	0.2	0	29.5	66.5	1.7	0.4	1.8	0.23	68.5	1.5	2.1	0.0
2001	0.62	0.22	0.19	0.2	0	30.8	64.8	1.6	0.4	2.4	0.22	41.3	0.9	2.3	0.0
2002	0.56	0.11	0.25	0.19	0	30.1	61.9	2.9	0.3	4.8	0.11	63.7	1.3	2.0	0.0
2003	0.54	0.15	0.22	0.17	0	30.3	62.7	2.1	0.3	4.6	0.15	52.5	1.2	2.3	:
2004	0.56	0.16	0.22	0.18	0	30.5	61.7	2.4	0.3	5.2	0.16	48.1	:	:	0.0
2005	0.57	0.18	0.21	0.18	0	33.4	57.7	2.9	0.3	5.7	0.18	50.2	:	:	:
2006	0.56	0.18	0.21	0.17	0	33.1	57.5	2.2	0.3	7	0.18	46.7	:	:	0.0
2007	0.57	0.17	0.2	0.19	0	34.3	58.6	0.2	0.2	6.7	0.17	50.9	4.5	8.8	0.0

Source: Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database, accessed May 2010; Central Statistical Office (2002, 2005) [1980-1990 GERD/GDP, 1994 BERD/GDP]

Business enterprise expenditure on R&D (BERD) has always been at low levels, and increasing it has been a challenge. It reduced over the years from 0.32% of GDP in 1994 to 0.23% of GDP in 2000, indicating the decline of industry-related R&D (cf. Pavitt 1997). Despite the growing innovation effort in the manufacturing sector (Kozłowski 2004), the share of the business enterprises as a source of R&D funding in manufacturing declined from 73.9% in 1995 to 50.2% in 2005. Low patent applications by Polish firms are another indicator of low R&D in industry in general.¹⁴¹ Underlying reasons are related first to market forces being not yet strong enough to stimulate

¹⁴¹The external patent record of Poland is not very promising. Although the total number increased from 154 in 1999 to 6327 in 2000 and 9039 in 2002, the applications to external patent offices such as European and US patent offices are around 100 applications each year in the period of 2000-2002. In the industries studied in this research, during 1998-2000, there are only 23 firms (with more than 49 employees) with at least one patent in the food-processing and beverages industry, corresponding to 1.3% of firms in this industry. Among clothing firms, this number reduces to 3, which corresponds to 0.4% of all clothing firms with more than 49 employees (GUS 2002).

innovation in industry and the state sector still having a large share and second to the government still learning how to conduct S&T policy effectively and developing a gradual awareness of its important role in stimulating innovation (Jasinski 2003).

OECD report on innovation in Poland (2007: 17) stresses that

“the lack of technological innovation and the low spending on R&D does not necessarily imply that Polish firms are not focusing their efforts on enhancing performance or on ‘innovation’ in a broad sense. Poland has experienced rapid productivity growth over the past decade (OECD, 2006), partly owing to a strong uptake of new technologies, including information and communications technologies (ICT), and a range of non-technological changes in the production process, including organisational changes, aimed at enhancing efficiency. Moreover, the low level of technological innovation partly reflects Poland’s industrial structure, with few large domestic firms, an industrial structure primarily focused on low-technology activities, and foreign multinational firms that typically conduct little R&D in Poland”.

In 2007, GERD of food-processing products and beverages sector was 4.5% of total manufacturing GERD of which the sector’s expenditure on instruments and equipment was 8% of that of manufacturing sector. These expenditures almost exclusively funded by the own funds of the enterprises (99% of the total expenditures in the food-processing sector) (GUS 2009). The share of BERD of food-processing in BERD of manufacturing seems to show a jump just before the recession in 1998 hit the industry (3% in 1997) after two years, the industry stabilised around 2% of BERD until when a high figure of 8.8% is achieved in 2007. Wearing apparel industry does not have R&D activities as such.

5.3.3 Innovation activities of Polish enterprises, with specific emphasis on food-processing and clothing industries

The available data on innovation activities in Poland is based on Community Innovation Survey-2, conducted by Central Statistical Office. According to this survey, authors who use this and other surveys conducted by CSO¹⁴² (Baruk 1997, Haudeville *et al.* 2002, Jasinski 2003), observe a relationship between innovation activities and GDP growth rates during transition (section 4.4.2).¹⁴³ Baruk (1997) finds with 1993 data that

¹⁴² The CSO questionnaire was containing six complex questions and sent to 3500 enterprises in the public and private sector. Out of 2430 replies, 1183 (48.7%) of them belonged to the public sector and 1247 (51.3%) to the private sector.

¹⁴³ The innovation activities were weaker and weaker following the deepening of recession during 1989–1991; stronger and stronger during the recovery period of 1992–94 and high growth period of 1995–97; and stabilised during the period of economic slowdown in 1998. However, the impact of innovation policies on the innovation activities is not as clear, though (Jasinski 2003).

in general no increase in the innovativeness of Polish enterprises in any explicit way, yet public-owned firms are not less innovative than the privately-owned firms.

Haudeville *et al.* (2002) confirm low innovativeness in the Polish firms, in the 1989-1998 period, on the basis of falling number of patent submissions and patented Polish inventions at home and abroad, and low share of new and modernised products in the industrial production sold as well as low share of high-tech products in exports. As Table 5.6 shows, the trend of innovative firms in all Polish manufacturing firms was as follows: A high percentage of innovative firms in 1994-1996, followed by a sharp decline in 1998-2000 and a remarkable recovery in 2005-2007 (also OECD 2007). The same survey reveals that 72.5% of the enterprises with more than 500 employees innovated new products, processes or in organisation in 1994-1996 (GUS 1997). In 1998-2000 period, 58.3% of the manufacturing enterprises with 250 or more employees in total number of enterprises were innovative (GUS 2005). This figure increased only to 59.4% in 2005-2007 (GUS 2009). These enterprises also declared that they spent 72.1% of their total expenditure on innovation activities in 2000, covering 67.7% of these expenditure through their own funds in 2003.¹⁴⁴

In 1999-2001, 28.4% of manufacturing enterprises in total number of enterprises declared that they introduced at least one non-technological innovation. These are new or significantly changed corporate strategies (10.2%), advanced manufacturing techniques (such as TQM) (7.6%), new or significant changes organisational structure (12.8%), significant change of marketing or design or other subjective changes in at least one of the products (18.1%). In 2001-2003, 10.5% of total enterprises declared having cooperation in innovation activities whose 8.52% with Polish and 4.34% with foreign partners (GUS 2005). In general, despite being one of the leading transition countries, in line with the trend in transition countries, Polish manufacturing firms are not innovative-active (see Dyker 2010). Yet, in particular, large Polish firms appear to be the innovative-active as compared to the small firms according to the CIS-2 as conducted by CSO.

¹⁴⁴ These expenditure on innovation activities cover expenditures on machinery and equipment, on patents, licenses and know-how, R&D, marketing, training, software, land and building, and others.

The same trend observed in manufacturing industry for innovating firms is valid for both food-processing and clothing industries during 1994-2007 period (Table 5.6). During the last period, most of the innovation comes from a significant improvement in product and processes in both industries, rather than an innovation new to the market. Revenues from the sales of innovative products correspond to around 10% and 3.5% of turnover in food-processing and clothing industries in 2004-2007 period respectively. And finally, there are more food-processing firms (almost 14% of total enterprises, which corresponds to 41% of innovation active food-processing firms) than clothing firms (only 4% of total enterprises, which corresponds to 37% of innovation active clothing firms) that actively cooperate for innovation activities.

Table 5.6 Innovation activities of Polish manufacturing, food-processing and clothing firms, 1994-2007

			Manufacturing	Food	Clothing
Enterprises which introduced innovation, in % of total enterprises	1994-1996	total	38.6	38.8	8.3
	1997-1998	total	30.2	26.9	5.4
	1998-2000	total	16.7	13.7	4.9
	2005-2007	total	36.9	32.1	10.1
		new or significantly improved products	29.6	25.2	6.5
		new or significantly improved processes	24.7	20.9	5.2
		of which new to the market	15.4	11.1	3.0
Revenues from sales of innovative products introduced in to the market (in % of total turnover)	2004-2006	total	17.6	10.8	3.8
	2005-2007	total	14.1	8.6	3.0
		new to the market	8.3	3.2	1.0
		only new to the firm	5.8	5.2	2.0
Industrial enterprises (over 49 employees) with established cooperation arrangements on innovation activities during 2005-2007	% of total enterprises		20.7	13.6	4
	% of total innovation active enterprises		54.2	41.1	37.1

Note: Food refers to food products and beverages sector, clothing refers to wearing apparel, dressing, dyeing and fur sector

Source: Central Statistical Office of Poland (1999, 2002, 2009)

In 2007, the share of enterprises with expenditures on innovation activity in food-processing and clothing industries was 25.3% and 6.8% of total innovating enterprises respectively (GUS 2009). The same year, the total expenditure of food-processing firms on innovation activity corresponded to 13% of that of manufacturing, a slight increase compared to 2000 (see Table 5.7). Within total manufacturing expenses, food-processing firms accounted for almost 37% of the marketing expenses for new or

significantly improved products (almost 15 percentage points increase compared to 2000), substantiating the push effect for the innovation in food-processing industry by domestic demand, as discussed in chapter 4 (section 4.3.2).

Table 5.7 Distribution of expenditures on innovation activity in 2000 and 2007, by type of activity in food-processing and clothing firms and large public and private firms

Distribution of expenditures on innovation activity in 2000, by type of activity									
	Total	R&D activity	acquisition of disembodied technology and know-how	software	building structures and land	instruments and equipment	of which imports	staff training connected with innovation activities	marketing for new or significantly improved products
	% in total manufacturing								
Food	11.4	2.6	4.3	4.4	10.8	14.4	9.8	0.9	21.8
Clothing	0.2	0.0	0.3	0.2	0.2	0.3	0.2	0.1	0.1
	% in total industrial enterprises								
Enterprises with more than 499 employees	72.9	71.4	82.9	68.0	74.7	73.4	77.6	18.2	73.0
of which	% in enterprises with more than 499 employees								
public sector	37.9	37.9	54.2	38.5	47.4	33.9	21.3	14.5	17.6
private sector	62.1	62.1	45.8	61.5	52.6	66.1	78.7	85.5	82.4
Distribution of expenditures on innovation activity in 2007, by type of activity									
	Total	R&D activity	acquisition of disembodied technology and know-how	software	building structures and land	instruments and equipment	of which imports	staff training connected with innovation activities	marketing for new or significantly improved products
	% in total manufacturing								
Food	13.1	3.7	13.1	7.7	10.9	14.3	11.6	2.6	36.6
Clothing	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.2	0.1
	% in total industrial enterprises								
Enterprises with more than 499 employees	68.1	74.6	72.0	69.8	67.1	67.7	71.7	30.3	70.3
of which	% in enterprises with more than 499 employees								
public sector	21.3	14.5	9.6	18.9	24.4	22.0	3.8	22.4	1.3
private sector	78.7	85.5	90.4	81.1	75.6	78.0	96.2	77.6	98.7

Note: Food refers to food products and beverages sector, clothing refers to wearing apparel, dressing, dyeing and fur sector

Source: Central Statistical Office of Poland - GUS (2002, 2009), own calculations

There is a significant acceleration in the acquisition of disembodied technology and know-how (9 percentage points) from 2000 to 2007, and slight increase in expenditure in software and staff training for innovative activities. Compared to food-processing firms, clothing firms' expenditure on innovation activities as a percentage of that of total manufacturing was so trivial to mention (0.2% in 2000 and 0.1% in 2007), whose half of it went to the purchase of instruments and equipment (54%) and almost one third of it to building structures and land (27%) in 2007 - categories that do not have much to do with innovation activities (calculations made by the author).

Since this research is interested in enterprises with more than 499 employees, Table 5.7 displays their distribution of expenditures on innovation activities. Except staff training for innovation purposes, these large industrial enterprises account for 68-83% and 67-75% of all expenditures related to innovation activities in Poland in 2000 and 2007 respectively, with private sector playing not only the major role in it but also an increasing share from 2000 to 2007, substantiating the successful privatisation of these firms in the 2000s (Table 5.4).

Table 5.8 Products introduced into the market as a percentage of sold production of products, 1997-2007

periods products were introduced in	Products introduced into the market as a percentage of sold production of products, 1997-2007								
	1995-1997	1996-1998	1997-1999	1998-2000	2001-2003	2002-2004	2003-2005	2004-2006	2005-2007
Manufacturing	20.9	22.4	24.7	18.5	23.8	23.8	25.1	20.2	16.2
Food	10.1	11.6	12.5	9.6	13.4	12.5	11.1	11.5	10.2
Clothing	1.6	2.6	6.6	2.4	8.2	4.8	4.8	5.9	3.2
Note: Food refers to food products and beverages sector, clothing refers to wearing apparel, dressing, dyeing and fur sector									
Source: GUS 2002, 2009									

Source: Central Statistical Office of Poland –GUS (2002, 2009)

Food-processing firms show significant improvements in their expenses to staff training, acquisition of disembodied technology and know-how, software and R&D activity from 2000 to 2007, indicating an emergence of awareness in the early 2000s for a need to give emphasis to firm-level upgrading, particularly managerial and process. During a ten-year period between 1997-2007, the food-processing industry appears to introduce an average of 11.4% of the sold production of products as new products into the market, while this is only 4.5% for the clothing industry, with significant peaks in periods 1997-1999 and 2001-2003, indicating not only their orientation towards domestic and export markets respectively but also the change in the market-orientation of clothing firms during international financial crisis from export to domestic markets (Table 5.8).

5.4 CONCLUSION

This chapter described the developments in the Polish economy and the S&T system since the beginning of the transformation. The Polish economy has been performing so well that it has been one of the most successful CEECs, overcoming the negative impacts of transformation quickly. Poland has been least affected by the recessions during the 2000s and continued to grow at a steady pace. The Polish model of transition has been successful due to the policies she has followed: Complete liberalisation of

private sector, rapid price liberalisation, hard budget constraints on SOEs, gradual disinflation, current account convertibility of the currency and almost complete foreign trade (Gomulka 2000). However, Polish S&T system was not aligned with these reforms; instead it was kept similar to the socialist top-down S&T system, which created barriers to development of innovation systems. The business sector accounted for not more than one third of the expenditures of R&D. The innovativeness of the firms followed a similar trend with the GDP growth. According to the statistics, food-processing firms were involved in innovative activities more than clothing firms during 1994-2007. These figures tell us very little about how some firms' innovativeness increased over the years and some did not. The following chapters aim at answering the ways firms upgraded during transition years under these abovementioned economic circumstances by looking at the dynamics of relationships of the firm.

Chapter 6 EVOLUTION OF NETWORKS IN POLISH FOOD-PROCESSING AND CLOTHING FIRMS IN THE 1990s

6.1 INTRODUCTION

This chapter provides new empirical evidence on the evolution of network types that were present in the Polish food-processing and clothing industries during the transition years, by using cross-tabulations and chi-square tests. Hence, it is a descriptive chapter that is based on the dataset created as a result of the interviews conducted in Poland in food-processing and clothing firms (section 4.3.5).

As explained in section 4.5, there are four types of networks this research is interested in. These are (i) knowledge networks that range from formal cooperation with universities, research institutes, and so on to informal relationships at personal level; (ii) production networks that range from subcontracting and licensing to cooperation with competitors, customers, suppliers, complementary firms in the industry and so on; (iii) distribution networks that range from cooperation with competitor, distributor or complementary firms to franchising and licence agreement; and (iv) arm's length relations that range from package technology purchases to cooperation with consulting firms, industry associations and agencies dealing with market research, human resource development and recruitment, advertisement and design to participation in fairs and exhibitions, conferences, seminars and symposiums.

6.2 AN OVERVIEW OF NETWORK TYPES

6.2.1 Distribution of Network Type by Industry Type

As Table 6.1 displays, there are 180 production and 40 distribution relations (38.5% and 8.6% of the total relations, respectively), 141 knowledge relations (30% of the total relations) and 160 arm's length relations (23% of the total relations). So, there is relatively even distribution of network types in the database, except the dearth of distribution networks which clearly indicates that distribution networks are a novelty (i.e. a completely new type of relationship) during the transition years.

Table 6.1 Distribution of network type by industry type and chi-square test results

	Total relationships (N=467)		Industry type (INDUSTRY)			
			Relationships of Food-processing firms (N=195)		Relationships of Clothing firms (N=272)	
	count	%	count	%	count	%
Network Type (NETYPE)						
knowledge networks	141	30.2	103	52.8	38	14.0
production networks	180	38.5	36	18.5	144	52.9
distribution networks	40	8.6	14	7.2	26	9.6
arm's length relations	106	22.7	42	21.5	64	23.5
Chi-square test (Asymp. Sig.): NETYPE	0.000		0.000		0.000	
Pearson Chi-Square Test (Asymp.Sig. 2-sided): NETYPE vs INDUSTRY TYPE			0.000			

Source: Own dataset, SPSS version 17.0

There is clear dominance of knowledge networks in the Polish food-processing industry over arm's length and production and distribution relations, indicating the reliance of firms in this industry on knowledge networks as the main external source of knowledge. Moreover, they have more flexible market-based arrangements that are free of control as well as horizontal interactions with various knowledge-intensive industries. They try to follow new advances through networking means that are available to them; they have almost never ceased to cooperate with the universities specialised in their segment. This is a traditional link inherited from the socialist system, which created a single specialised university in each region in the country (e.g. Agriculture Academies in Olsztyn, Poznań, Kraków, etc.) that were specialised in preparing food-processing technologists in specific segments of the industry. Graduates of these institutions were allocated to the firms; as a result, today the firms know to which university to turn for solutions and graduates. The informal links of the graduates with their professors in these universities have always continued for simple problem-solving activities and, with the introduction of market economy forces, extended to projects on process improvements and product development. So, for the Polish food-processing firms that have sustained relationships with agents such as universities, this made a big difference in the capability development for upgrading.

Clothing firms account for most of the production and distribution networks studied here. As mentioned above, based on the global changes in the industrial structure of the clothing industry, it is expected that firms have relatively high number of production

relations. Moreover, production networks have been more important than knowledge networks because knowledge that is necessary for clothing production has been coming through production links. Arm's length relations account for one fifth and one fourth of relations in the food-processing and clothing firms respectively. The low percentage of knowledge relations in clothing firms indicates that there is some –albeit limited - degree of interest in external knowledge sourcing through relations other than production networks and value chains.

In both industries, distribution relations represent less than 10% of the relations. This is related to the fact that distribution networks did not have a past like other linkages. Marketing and distribution activities were not part of firm activities during the socialist period and were still developing during transition years; so distribution networks were one of the main weaknesses in the CEE networks at the time of this research as well as a firm function firms were making great efforts to develop. The efforts to include distribution networks in the emerging networking system indicate a focus on functional upgrading (aimed at integrating distribution and production activities). Some of the firms learn distribution network development while in a relationship with foreign and/or domestic firms specialised in marketing and distribution. There is evidence of foreign firms' cooperation with CEE partners in distribution network development; making use of the latter's local market knowledge. Examples can be found in my earlier works, such as Romanian bakery Dobrogea's joint venture with Danish Palsgaard which allowed Dobrogea to become a licensee of Palsgaard in distribution and allowed Palsgaard to penetrate an emerging market (Yoruk, 2002b), and Polish clothing company Vistula's partnership in distribution of a quality foreign brand, Artisti Italiani, as a licensee of the latter which opened the way for learning to become a fashion designer and distributor instead of being solely a producer (Yoruk 2002a). The Pearson Chi-square test result shows that there is a relationship between both of the industries and the network types and it is statistically significant at 1% level.

In summary, as the distribution of relationships in both industries in Table 6.1 substantiates, the comparison of Polish food-processing and clothing industries will particularly advance our understanding whether upgrading opportunities for domestic LMT firms are necessarily restricted to strong governance structures in GVCs / GPNs or not.

6.2.2 Distribution of Network Type by Type of Partner

The selection of partners with which firms do, and sometimes do not, collaborate has been the focus of network studies (Håkansson 1990a, Lepionen 2002). It is an essential part of networking that targets increasing firm competitiveness. In this research, particularly in an environment characterised by the rejuvenation of market relations, the *partner type* is important to show not only where the sources of knowledge lie that meet the needs of the firms, but also the changes in the dynamics of relationships in the emerging markets. This section will look at its association with the network types Polish food-processing and clothing firms were involved in during the transition years. Table 6.2 displays the shares of networks established with different type of partners in both industries.

Table 6.2 Distribution of network type by type of partner, by industry type

	% in Total relationships (N=467)			Industry type (INDUSTRY)					
				% in Relationships of Food- processing firms (N=195)			% in Relationships of Clothing firms (N=272)		
TYPEPARTNER	research partners	industrial partners	VC partners	research partners	industrial partners	VC partners	research partners	industrial partners	VC partners
NETYPE									
knowledge networks	29.1	66.7	4.3	34.0	66.0	0.0	15.8	68.4	15.8
production networks	0.6	18.9	80.6	2.8	16.7	80.6	0.0	19.4	80.6
distribution networks	0.0	35.0	65.0	0.0	7.1	92.9	0.0	50.0	50.0
arm's length relations	4.7	77.4	17.9	7.1	88.1	4.8	3.1	70.3	26.6
Total (count)	10.1 (47)	48.0 (224)	42.0 (196)	20.0 (39)	57.4 (112)	22.6 (44)	2.9 (8)	41.2 (112)	55.9 (152)
Chi-square test (Asymp. Sig.):TYPEPARTNER	0.000			0.000			0.000		
(Asymp.Sig. 2-sided): TYPEPARTNER vs INDUSTRY				0.000					
TYPEPARTNER vs NETYPE	0.000			0.000			0.000		

Source: Own dataset, SPSS version 17.0

Type of partner in this research is designed in the broad sense of linkage types to represent horizontal and vertical linkages. Emerging-market firms get involved in relationships with a wide spectrum of partners that can be categorised into vertical relations with value chain actors and horizontal relations with industrial and research partners. Value chain (VC) actors can be customers and suppliers, distributors, intermediary firms; industrial partners can be complementary firms, technology supplier, competitors, sister companies and strategic investors; and research and design

partners can be universities, public and private research institutes and labs, consulting firms and agents, and designers.

The major types of partners that Polish food-processing and clothing firms established relationships with are industrial partners and VC actors (48% and 42% of total relations). The relationships with these two partners were particularly dominant in the Polish clothing industry (41.2% and 55.9%). Polish food-processing firms establish more relationships with industrial partners (57.4%) than VC actors (22.6%) or research partners (20%). Still, the cooperation of Polish food-processing firms with their VC partners has more scientific content than that of Polish clothing firms. For instance, the former are accessing new technologies and sources of knowledge through cooperation with their upstream partners. However, some very exceptional firms have the necessary knowledge base to conduct basic research and technological capability to apply it in practice. An example is Agro Sokółów, the agriculture subsidiary of one of the biggest Polish meat-processing companies, which works with Cargill, the feed producer, since January 2001 (Yoruk 2002c, Yoruk and von Tunzelmann 2001).¹⁴⁵ Research and design partners make up 10.1% of total relations. Compared to the Polish clothing firms, they were more important for food-processing firms as partners in knowledge networks (the latter cooperated with research partners around 6.5 times more than clothing firms).

The Pearson chi-square test is significant at 1% level for the relationship between the type of partner and network, indicating that there is association between the two. When the industry differences are controlled for, the relationship between network and partner types appear to be statistically significant at 1% level for both industries.

¹⁴⁵The simple supplier-customer relationship has been transformed into cooperation for developing best possible feed according to the genetic characteristics of the herd in Agro Sokolow. Cargill has been responsible for developing the feeding program for all animal farms of Agro Sokolow. During importation, Danish supplier firm provides the data related to each pig, which is shared with Cargill. Furthermore, Agro Sokolow informs Cargill what ratios of which ingredients it expects to have in feed. For instance, Agro Sokolow determines feed consumption per 1 kg of weight as 2.6kg, despite the normal consumption is 3kg. The objective of Agro Sokolow is to decrease the feed consumption in order to decrease cost of production, as the outcome does not change when this parameter decreases with the increase in daily breeding speed and the better conditions like heated floor, better ventilation, etc. To assure the requests of Agro Sokolow, researchers from Cargill regularly visit Agro Sokolow twice a month and discuss the results and problems. As well as the feedback, Cargill gets genuine input-output data of Agro Sokolow to conduct its own research. The other breeding center of Sokolow in Chotyniec which supplies Jaroslaw and Tarnow plants works with the other well-known feed supplier, Central Soya. They work in cooperation to develop protein feed that yields quality and efficiency to these meat processing plants (Yoruk 2002c).

6.3 EVOLUTION OF NETWORK TYPES OVER TIME

This section aims at having a closer look at the impacts of over ten years of transition on networking activities in Polish food-processing and clothing industries. As explained in section 5.2, the transition years have been divided into three stages as early 1990s (years of transformational recession), mid-1990s, and late 1990s and early 2000s.¹⁴⁶

6.3.1 Type of Network over time, by industry type

Table 6.3 below exhibits the evolution of types of networks in each industry over time. The periods chosen to represent transition years are significantly associated with network types (at 1% level) and both of the industries (at 1% level for food-processing firms and 5% level for clothing firms).

A little more than half of the total relationships in the dataset (56.1%) were established in the late 1990s and 84.4% in the mid- and late 1990s, with only 15.6% starting in the early transition years. Although the latter group of relationships account for less than one sixth of the total, including the early years helps us to understand the pattern of evolution of networks in a dynamic context.

In general, there is a significant systematic increase in the number of relationships throughout the transition in both industries. The number of new relationships established by Polish food-processing and clothing firms dramatically increased in the late 1990s as compared to mid-1990s (on average around 50%). The rate of increase from early 1990s to mid-1990s was significantly higher in the Polish food-processing firms (65%) than in the Polish clothing firms (28%). Relationships re-emerge in the mid-1990s after the first shock had been overcome, as the number of relationships almost doubled in mid-1990s compared to early years of the transition. Such increase indicates a developing awareness among Polish LMT firms of the importance of networking over the course of the transition years.

Knowledge networks were steadily increasing towards the late transition years; in other words, all firms started establishing more knowledge networks in the mid-1990s compared to early 1990s and continued to do so in the late 1990s. More than half of the

¹⁴⁶ Hereinafter in the text, the last stage is going to be referred as late 1990s.

relations of all firms in the early 1990s were composed of production networks; in other words, production networks clearly helped the survival of firms in the early transition years. However, this came to an end in the mid-1990s in favour of establishing knowledge networks and arm's length relations. Moreover, the reduction in the number of relations in the production networks from early to mid-1990s indicates withdrawal from the inherited production relations, which still managed to survive in the early 1990s, and re-establishment of new relations in the value chain in the mid-1990s. There is only a slight increase in the proportion of production networks of all firms in the late 1990s compared to mid-1990s. This means that the number of relationships does not decrease, but only a few new relationships started in the late 1990s. While the share of distribution networks has been constantly growing with the emergence of awareness of the importance of distribution in business, arm's length relations lost their importance as a source of knowledge in the late 1990s as compared to early and mid-1990s, which seems to be compensated by the increase in the share of distribution and knowledge networks in the late 1990s by Polish food-processing and clothing firms respectively. Another reason for such compensation might be the external shocks, such as economic downturn that started in 1998 and continued throughout early 2000s (Chapter 5), which led firms to cut their long-term investments in technology acquisition and focus on short-term business activities.

When the relationship between network types and time period is controlled for the effects of the industries, this relationship is statistically significant at 1% level for Polish food-processing firms while significant at 5% level for the Polish clothing firms. This indicates time period and network types are associated for both of the industries. In other words, there are some differences between the time periods with regard to the distribution of network types for both industries. Hence, Table 6.3 helps us to further distinguish between industries.

As expected, in the early 1990s, the Polish food-processing firms (in total 20 relations consisting of 10.3% of the total relations) had limited number of relationships compared to the Polish clothing firms (in total 53 relations consisting of 19.5% of the total relations). As discussed in section 4.3.1, the underlying reasons are mostly related to the performance of the industries in the early transition period. The food-processing industry was not performing well at all in almost all transition countries (Hanzl, 2000).

With the transition, food-processing firms experienced a time lag to understand the functioning of the new system and identify their deficiencies in that system. This faltering stage for the Polish food-processing firms took place (as in many other sectors) in the early 1990s when the attention of most of the firms was focused completely on business activities that they did not know before transition. Large Polish clothing firms were already in production networks with foreign customers under OPT regime since the 1980s, which became the dominant form of production for the clothing firms in the early 1990s (Pellegrin 2000, Pickles *et al.* 2006, and my interviews) and therefore facilitated their initial access to export markets through integration into GVCs / GPNs. Being open to Western links in the 1980s put the Polish clothing firms initially in an advantageous competitive position over their counterparts other CEECs.¹⁴⁷ The gap between the two industries in networking activities closed in the mid- and late 1990s; yet each industry focused on different type of networks.

Table 6.3 Distribution of network types over time by industry

	% in Total relationships (N=467)			Industry type (INDUSTRY)					
				% in Relationships of Food-processing firms (N=195)			% in Relationships of Clothing firms (N=272)		
PERIOD	early 1990s	mid- 1990s	late 1990s	early 1990s	mid- 1990s	late 1990s	early 1990s	mid- 1990s	late 1990s
NETYPE									
knowledge networks	13.7	32.6	33.6	25.0	58.6	54.7	9.4	12.2	16.6
production networks	58.9	28.0	38.2	45.0	10.3	17.9	64.2	41.9	54.5
distribution networks	2.7	7.6	10.7	0.0	3.4	10.3	3.8	10.8	11
arm's length relations	24.7	31.8	17.6	30.0	27.6	17.1	22.6	35.1	17.9
Total (count)	15.6 (73)	28.3 (132)	56.1 (262)	10.3 (20)	29.7 (58)	60 (117)	19.5 (53)	27.2 (74)	53.3 (145)
Chi-square test (Asymp. Sig.): PERIOD	0.000			0.000			0.000		
Pearson Chi-Square Test (Asymp.Sig. 2-sided): PERIOD vs INDUSTRY TYPE				0.025					
PERIOD vs NETYPE	0.000			0.003			0.040		

Source: Own dataset, SPSS version 17.0

The growth in relationships over the transition years, reflected by the increases in the share of relations started in a particular period in the total relations, for the Polish food-

¹⁴⁷ This is closely linked to the advantageous early exposure of Poland to the market economy ('market socialism') in the 1980s particularly with Western Europe (section 5.2.5). With transformation, the presence of these linkages not only served as a mean for their survival, but also, compared to food-processing firms, led them initially to abandon their national system of production and focus on these linkages. This is not surprising as the literature has observed similar trends in other emerging regions in this industry (discussed in Chapter 2).

processing firms (from 10.3% in the early 1990s to 29.7% in mid-1990s, and to 60.0% in the late 1990s) was similar to that seen in Polish clothing firms (from 19.5% in the early 1990s to 27.2% in the mid-1990s, and to 53.3% in the late 1990s) (Table 6.3). However, when the percentage distribution of network types by industry type is examined in detail, I see that the relations of Polish clothing and Polish food-processing firms evolve in different patterns.

The Pearson chi-square test is significant at 5% level for the relationship between time period and industry type, indicating that there is association between the two. The relationship between network type and time period is statistically significant at 1% level for the dataset. When industry type is controlled for, this relationship appears to be statistically significant at 1% level for the food-processing; however, it is significant at 5% level for the clothing industry. This indicates that while there is a confirmative relationship between time period and network type for food-processing firms, there is a suggestive relationship between time period and network type for Polish clothing firms.

6.3.1.1 Polish food-processing firms

Knowledge networks

As already shown above (section 6.2.2), in general, Polish food-processing firms overwhelmingly have knowledge networks compared to the Polish clothing firms. More than half of the relationships of food-processing firms accumulated in knowledge networks since the mid-1990s, while on average half of the relationships of clothing firms accumulated in production networks throughout the transition years. Clothing firms were quicker to respond to the need to develop distribution networks and started increasing the share of distribution networks in the mid-1990s. Despite a sluggish start, food-processing firms caught up with the mid-1990s levels of clothing firms in the late 1990s. While food-processing firms also appear to gradually decrease the share of arms' length relations over the years, clothing firms emphasised increasing the share of arm's length relations in the mid-1990s, only to see them stagnate in the late 1990s.

Production networks

For Polish food-processing, in the early 1990s, production networks played a significant role as the source of knowledge alongside arm's length relations (45% vs. 30% respectively). A pattern of networks in which production relations define the early

progress of networks is observed in the food-processing industry. As expected, Polish LMT firms were not capable of embarking on transformation processes, partly because of lack of finance but largely because of not knowing what to do and how to do it. However, they maintained their production relations, even if they were not efficient at the time. Relations with the upstream could not have any break: the dairy cooperatives had close links with their milk suppliers, sugar plants purchased sugar beets only from the farmers in their regions, potato-processing firms collaborate with potato farmers for the special kind of potato they needed, and so on. Considering that these relationships have started in the early 1990s as compared to the late 1990s, the progress of upgrading through interaction in production activities and the development of capabilities to transfer knowledge within these interactions is naturally expected to make a big difference in the supply sector in the Polish food-processing industry. As the knowledge networks became more important sources of knowledge for food-processing firms, arm's length relations gradually declined while production networks sharply lost their importance in the industry. Later in the late 1990s, links with upstream suppliers were transformed into systematic knowledge sharing networks for the purpose of assuring input quality and output quantity (discussed in the context of farmer subcontracting below), increasing the share of production networks in order to reduce continuing deficiencies in production knowledge (in areas such as product design), (which slow down the process of catching up with Western Europe), and improving the ability to compete with the MNC subsidiaries in the domestic markets.

Distribution networks

An increasing awareness of the importance of distribution networks in the Polish food-processing industry after the first shock of transformational recession led to a dramatic increase in distribution relations by the late 1990s (from 3.4% of relations started in mid-90s to 10.3% of those started in late-90s).

Arm's length relations

From the beginning of transformation, Polish food-processing firms were constantly involved in arms' length relations; mostly in the form of package technology transfer with the aim of accessing knowledge and technology from abroad and as one of the main investment efforts, particularly in the mid-1990s. Competition had become very fierce, and EU membership was knocking on the door. The emerging awareness of

export opportunities in the late 1990s hastened this process of modernisation among the large food-processing firms. Most of the arm's length relations of Polish firms were concentrated on technology acquisition, accompanied by mobility of technicians for the purpose of installation and training.

6.3.1.2 Polish clothing firms

Production networks

Production networks appear to be always dominant in the Polish clothing industry during transition years. As mentioned above, production networks with foreign firms abroad date back to before transition.¹⁴⁸ This historical cooperation was realised in exports of semi-finished and finished garments to capitalist markets through FTOs. In the early 1990s, Polish clothing firms effortlessly gained more access to these networks (64.2%), as global buyers came and found these firms. They became suppliers to Western firms that governed the GPNs (section 2.2). The latter were particularly attracted to CEE firms first and foremost due to geographical proximity and low labour costs (which lost its attractiveness mid-1990s onwards with the recovery of the Polish economy, section 5.2). However, when compared to South East European countries, Polish clothing firms were attractive due to their prompt response and adaptation to the requirements of these production networks with their skilled labour. In the mid-1990s, increasing labour costs in Poland shifted the interest of Western clothing firms to other CEECs. By then, some of the Polish clothing firms had developed vision for the future of the industry that relied on becoming OBM at home and abroad. Starting in the mid-1990s, most of these firms focused more on knowledge networks for new product and process development as well as on increasing their market presence through improving distribution networks. Some have failed and focused on re-gaining foreign customers by attracting them with their competence in high-quality production while some have become successful and organised production networks at home while continuing relations with global buyers by operating in multiple chains.

¹⁴⁸ There is a history of cooperative activities between CEE and West European enterprises before transition particularly in technology transfer. Saunders (1977) focuses on R&D cooperation between East and West European firms by either surveying the West European firms which cooperated with East European firms or case studies of East European firms that cooperated with West European firms in different industries.

Distribution networks

Polish clothing firms focused on developing their distribution networks at home from the mid-1990s onwards. They cooperate with other domestic firms (distributors, to increase their domestic market share, or intermediaries, to find foreign customers), with competitors for market research, and with complementary product suppliers for distribution. Nevertheless, knowledge networks had never been as significant as in the Polish food-processing industry, and only played a complementary role to the knowledge sourced from production networks.

Arm's length relations

The early 1990s witnessed a modernisation almost from scratch through arm's length relations, with an attempt to attract more global buyers and increase their share in the global production as much as possible. Investments in new technology continued in the mid-1990s as growth strategy for Polish clothing firms, while up-dating machinery and equipment to attract foreign customers, as a strategy, lost its importance by late 1990s. In either case, an effort to improve technology (for new processing techniques and products) and knowledge base (particularly in business and marketing) in the mid-1990s led to an increase in the proportion of production networks once again in the late 1990s, since the main positive effect of new technology purchases mentioned by the clothing firms is the ability to increase productivity and therefore attract more foreign customers.¹⁴⁹ Design is an area in which the Polish clothing firm has to be strong when it comes to give feedback and cooperate with the technology suppliers in the clothing industry. However, this is not a question for the transition country firms so far.¹⁵⁰ As a result, with the experiences gained, the content and the structure of these networks changed considerably when compared to those in the early 1990s.

Polish clothing firms have relatively quickly become technologically well-equipped and financially endowed, thanks partly to their long-term foreign customers from before and

¹⁴⁹ Most of the time, the new or specialised machinery and equipment were either introduced to the Polish clothing firms by the foreign customers or demanded by the foreign customers for beginning or continuation of their relationship.

¹⁵⁰ A small entrepreneurial clothing firm with design capabilities and distinctive market capabilities in Poland was interviewed for a Polish research project. Its attempt to communicate with the big international raw material suppliers – not even the technology suppliers – for the development of innovative materials for its designs shows that the suppliers are not interested in feedback from the small players in the global clothing industry, but only from big designers with high volume of demand (Yoruk and Woodward, 2005).

immediately after the transition. Polish clothing firms pursued technological changes in the industry more closely in the late 1980s than their CEE counterparts and gradually continued almost all the time throughout the transition. Among Polish companies, today's stronger market leaders had their own CAD systems just before, or at the time of, the transition (at the latest in the mid-1990s), although automatic cutting machines were not introduced in Polish firms until the late 1990s.¹⁵¹ This gave them both financial and technical opportunities to direct their attention to the domestic market and improve their own brand names earlier than their CEE rivals, since at the back of their minds, Polish producers have thought that whatever investment they do will work for their own brand rejuvenation.

The modernisation efforts of Polish clothing firms at the beginning of the transition have turned into catching up efforts with the new technology over the transition years. This is a way of keeping their market from slipping through their fingers into the low labour cost countries. Such following of the technological advances in the industry has of course positively influenced the capability accumulation of the clothing firms. Polish firms have been enjoying the advantages of having started modernisation earlier than other CEE suppliers, enabling to develop their own domestic strategies when the OEM market started stagnating for them.

6.3.2 Type of partner over time, by industry type

This section examines the changing patterns of networking activities of Polish food-processing and clothing firms with regard to abovementioned three partner types over the transition years (Table 6.4). VC actors appear to be the most significant partner type in the early 1990s. In the mid-1990s, new relationships with VC actors reduced to around half of the relationships that started in the early 1990s, particularly due to the food-processing firms' increasing number of relationships with industrial and research partners. After a stagnation period, in the late 1990s, relationships with VC actors started to rise again, particularly to the detriment of new relationships with industrial partners, mostly in the food-processing industry.

¹⁵¹ Having CAD systems as early as possible has been a competitive advantage among the firms competing in any given country, as this is one of the main criteria of the foreign buyers when they look for suppliers (according to information gathered through questionnaires sent to some of the clothing firms' foreign partners). It is also a sign of quicker industrial upgrading by shifting, and even leapfrogging, from less to more advanced stages of production processes in the clothing industry.

Over the transition years, the share of relationships established with research and design partners increased from almost non-existent levels (1.4% of relationships started in the early 1990s) to considerable levels (9.8% in the mid-1990s and 12.6% in the late 1990s), an effect driven by developments in the Polish food-processing industry.

Table 6.4 Distribution of type of partner over time, by industry type

	% in Total relationships (N=467)			Industry type (INDUSTRY)					
				% in Relationships of Food- processing firms (N=195)			% in Relationships of Clothing firms (N=272)		
PERIOD	early 1990s	mid- 1990s	late 1990s	early 1990s	mid- 1990s	late 1990s	early 1990s	mid- 1990s	late 1990s
TYPEPARTNER									
research partners	1.4	9.8	12.6	5.0	19.0	23.1	0.0	2.7	4.1
industrial partners	38.4	56.1	46.6	60.0	69.0	51.3	30.2	45.9	42.8
VC actors	60.3	34.1	40.8	35.0	12.1	25.6	69.8	51.4	53.1
Total (count)	15.6 (73)	28.3 (132)	56.1 (262)	10.3 (20)	29.7 (58)	60 (117)	19.5 (53)	27.2 (74)	53.3 (145)
Chi-square test (Asymp. Sig.): PERIOD	0.000			0.000			0.000		
Pearson Chi-Square Test (Asymp.Sign. 2-sided): PERIOD vs INDUSTRY TYPE				0.025					
PERIOD vs TYPEPARTNER	0.001			0.046			0.156		

Source: Own dataset, SPSS version 17.0

The Pearson chi-square test results are the same as for Table 6.3 above. It is different only when the industry type is controlled for: The relationship between time period and partner type appears to be significant at 5% level for the food-processing industry but not significant at all for the clothing industry. This indicates that there is a suggestive relationship between time period and type of partner for Polish food-processing firms, while there is no association between time period and partners the relationships were established with for the clothing firms.

6.3.2.1 Polish clothing firms

VC actors appear to be the most significant partner type for Polish clothing firms at all time. Being an integral part of GVCs/GPNs, their main partners were always value chain actors. However, as Table 6.4 shows there has been an adjustment in the relationships with regard to partners the clothing firms started cooperating with. From the mid-1990s onwards, the share of industrial partners in the relationships of the firms improved so significantly that it caught up with the VC actors. This can be taken as an indication for development of different form of relationships in the Polish clothing

industry other than GVCs / GPNs, such as production networks at national level and distribution networks.

The experience in GVCs/GPNs with foreign partners appears to be a stepping stone to the development of production networks at home (my interviews). As labour costs in Poland started increasing vis-à-vis other low-cost CEECs such as Romania and Bulgaria particularly since the mid-1990s, most of the Polish clothing firms redirected their attention and production efforts to expanding their market share in the domestic market by nourishing their own brands. Because strategic reorientation towards domestic market was possible through sustained/stable financial gains from being involved in GVCs/GPNs, OPT/OEM relations continued, albeit with less interest in forming closer links with the foreign customers.¹⁵² By 2001 (when the interviews were conducted), despite the decrease in the share of OEM production in total production of Polish clothing firms, they were still considerable OEM producers for the foreign global buyers with an increasing interest in links for domestic market development. In the case study on Vistula, I have discussed how Polish clothing firms imitate, within the national boundaries, the way GPNs are organised and governed (Yoruk 2002a). Such developments are acknowledged in the firm-level upgrading discussions in the literature but rarely observed in other emerging markets as they represent a functional upgrading to higher value added activities (in contrast to product upgrading through imitation of buyer's products), which is viewed as creeping into the territory of the buyer firms and most often not welcomed and even hence prevented, if possible, by deliberate strategies of the buyer firms (e.g. limiting learning opportunities by high level of protectiveness).¹⁵³

Yoruk (2004) introduce the well-developed web of production relations among large firms and between large and small firms in the Polish clothing industry. The domestic production networks (DPNs) started with the use of a group of small workshops and firms by the large firms due to problems in their production capacity, which became

¹⁵² However, this situation does not affect many Polish clothing companies in terms of OEM relations; instead the import of garments into the domestic market from cheap world producers by street sellers at the price of the fabrics that Polish companies use threatens their survival (interviews with large Polish clothing firms in 2001).

¹⁵³ Most recent examples for such successes in the literature are from Turkish clothing firms having their national production networks for both domestic and international marketing (Tokatli and Kizilgun 2004, Tokatli and Eldener 2004, Tokatli 2007).

inadequate to supply the quantity ordered by global buyers. In order not to lose the customers, Polish clothing firms transferred cut and make, cut, make and trim activities to these small units where they started exercising the control and cooperative relations similar to what those the global buyers had had with them for years.

For these large Polish clothing firms production networks were not only comprised of relations with global buyers (despite their bigger share in their production). After some time, being part of GPNs/GVCs became a commercial activity for Polish firms where even the margins gradually become negligible due to appreciation of the national currency. Gaining experience in managing abovementioned supplier networks, a few first mover firms initiated DPNs in a similar fashion to global buyers, yet with a new dimension that has not (to my best knowledge) been mentioned in the literature on other emerging markets. These firms with strong national brands tried to develop production networks for their own brand products at home rather than going global. Some became successful, some failed. Some attempts are a result of learning from and imitating foreign customers, while some are indirect spillover effects of the successful Polish imitators of global buyers in the domestic market. The large clothing firm which functions as network organiser contracted other large clothing firms that were each specialised on a clothing item that was not specialisation of the network organiser (these firms are originally horizontal industrial partners, at least before being involved in DPNs). So, sometimes the contractor worked as an ODM (just as in their relationships with the global clothing retailers), and sometimes the network organiser worked in close cooperation with the contractor and supervised throughout the design and production (just as the global buyers). The ODM partners were other large Polish clothing producers with strong national brand names of their own, and the relationship between these firms and the network organiser was either a contract-based relationship (market-based chain in the terminology of Humphrey and Schmitz (2004a)) or a relationship based on strong ties that extends into cooperation in distribution. These DPNs created value added when compared to production networks created with small firms that were subcontracted to meet the increasing demands of global buyers. This was because there was much more flexibility with regard to learning opportunities among the partners than in the production relations in the supplier networks with small firms, where large clothing firms were governing the 'chain' rather than organising the 'network'. Therefore, such production networks at national level created business alternative for

large clothing firms to being captive in GVCs/GPNs, as long as the network organisers continued to be successful. As successful cases/examples started to appear, it also created incentives for focusing on domestic market and increasing market share; ability to create such DPNs became a source of competitiveness. Establishing their own brands at home had not been more significant than any other time first and foremost for survival reasons, as the move of foreign customers to low-cost countries had already started at the time of our interviews in 2001.

6.3.2.2 Polish food-processing firms

Although not as much as clothing firms, food-processing firms have shown significant developments with their VC partners over the transition years. First, they engage in two types of relations with suppliers in production networks that lead to significant knowledge transfer. While in one of them food-processing firms are the recipients of the knowledge, in the other they are the providers of the knowledge. The former is relations with foreign input suppliers (e.g., animal feed producing MNC subsidiaries) in the form of collaboration for experimentation and training provided to the Polish food-processing firm, and the latter is with domestic raw material suppliers (i.e. farmers) in the value chain, called farmer subcontracting. This is one of the most striking developments in the Polish food-processing industry which allows Polish owned food-processing firms to organise DPNs, particularly in the upstream food-processing industry. When the raw material lacks the quality required for the process technology in use, many unexpected problems arise. This problem has been spotted first by the foreign owned firms soon after they entered the Polish market (e.g., Yoruk 2002d), and farmer subcontracting was initiated by them. It has been effectively imitated by the Polish food-processing firms over the years and turned into a success. Linkages with farmers in the upstream allow them to overcome systemic quality and quantity problems. Firms have developed relationships wherein their in-house agronomists work closely with their contracted farmers and teach them how to get the best and most produce by using new materials and different agricultural techniques. Moreover, employing in-house agronomists has significant implications for upgrading in the food-processing firms, which leads to gradual improvement of the product and process development within the firm via its effect on the quality of the final product, and is also an indicator of functional upgrading.

In addition, improvements in the quality of agricultural produce have forced firms later on to act as network organisers in the local supply chains. On the supply side, this approach to networking and organising networks determines the quality management policy of firms with their agricultural suppliers. On the demand side, food-processing firms have also been compelled to pursue ISO certification. Moreover, at the time of this research, Polish firms were obtaining these certificates due to the incentives of becoming an EU member state as well as perceiving them as the only route to export to the EU.

Second, as food retailing is undergoing a transformation, there is also a downstream activity within the production networks of food-processing firms that they gradually become involved in, called private-label subcontracting and defined as production of a complete product of the domestic producer firm's product portfolio, to be marketed and distributed either under the brand name of the buyer or under another brand name apart from that of the buyer, e.g. food-processing products for Tesco, garments for Metro. Wholesalers were still the intermediaries that producer firms were largely dependent on. The retailing sector started its transformation only after FDI became interested in Poland in the mid-1990s (e.g. the British retailer Tesco entered Poland in 1995).¹⁵⁴ There were companies that continued their historical links in private label production in special products to export markets, such as goose exports to Germany by Indykpol. However, in the same period, there were also cases of large food-processing producers (e.g. Sokołów) that refused to work with big (mostly foreign) retailers in order not to be trapped by the strict pre-conditions of retailers, such as the retailer returning the product one week later if not sold. (In this particular case, one year later, the retailer agreed to the conditions of the food-processing producer to retain the product quality its

¹⁵⁴ The mid-1990s witnessed growth in retail sales: in 1996 the volume of sales was 4.5% more than in 1995. In 1996 the number of retail outlets decreased by about 20,000 due to the closure of small shops (50 sq m). At the same time 187 new large stores with a floor area of more than 400 square meters were opened. The number of customers per outlet in Poland in 1996 was 95, far fewer than the 330 in France and 500 in Hungary (www.paiz.gov.pl). The fragmented and fast-growing structure of the Polish retailing market is the main attraction to foreign investors eager to exploit profitable opportunities. In addition, the liberalization policies, the political framework and government incentives play a role (Pearce 1999). Foreign-owned firms accounted for 40% of the turnover of the 50 largest retailers, and the share of firms that were fully or partly owned by foreign trading enterprises amounted to 28% in 1997 (Works 1997). FDI has a huge presence in the Polish retail sector. In 1999 Poland attracted more than \$2.2 billion of foreign investment in the retail and wholesale trade, with a further \$2.8 billion of planned investment due to the country's huge potential. Professor Marian Struzycki, director of the Institute of Domestic Market and Consumption, predicted that the share of hypermarkets in food-processing sales would continue to rise at least to 2005 and that, ultimately, large retail chains would account for 45-50% of Poland's total food-processing sales (see the Tesco case study of Yoruk and Radošević (2001)).

customers look for). On the other hand, most of the food-processing producers in dire straits submit to such capture by the impositions of big retailers, lowering the price for quality products to be able to fight against their competitors with strong financial and technological standing in the market.

Both types of subcontracting lead to the introduction of new functions within the firm. Farmer subcontracting activity, a spillover effect of the FDI in Poland, leads to creation of an agronomy unit, i.e. raw material improvement via firm agronomists, while private label subcontracting activity is associated with dramatic changes in the policy of marketing and distribution. In some firms, exporting by means of private label subcontracting has become significant as well. In all these relations, knowledge transferred in these networks is mostly technical and usually transferred through inter-personal communication.

Moreover, for Polish food-processing firms, industrial partners were unquestionably the main partners. On the other hand, they made an increasing use of research partners as source of knowledge over the transition years. These firms have started to rely on knowledge acquired from networks with domestic scientific organisations (universities and research institutes) as well as foreign consulting agencies in the late 1990s, when process innovations with the existing technology became the trend in this industry. The foreign owned consultancies were suggesting product diversification in the market as a new growth strategy for firms. The optimal way to realise this was through application of possible variations in the process technologies that could be achieved through new scientific and technical knowledge. The sources of the latter kind of knowledge for Polish firms include vertical and horizontal links with a broad range of agents in the economy. Moreover, in Polish food-processing industry, numerous kinds of relationships with universities and research institutes dated back to before transition. These relationships resumed after some time in a different framework, particularly because some of the research institutes have transformed themselves in accordance with the changing conditions. As a result of weakening support from the state, many of these institutes had to close down, but the ones that managed to source finance through new marketing techniques have even gradually started to participate in EU framework projects (Box 1, section 5.3.2). Polish food-processing firms also have strong reliance on domestic universities and research institutes for knowledge gathering based on

subcontracting links that produce licensed process technologies or products (e.g. a non-allergenic ingredient for juice for Agros SA). Hence, in most cases, such knowledge gathering does not go further than appropriating the knowledge generated elsewhere. Finally, the share of research partners was close to that of VC actors in the late 1990s, which - in addition to their role in production networks - were engaged in distribution networks as part of Polish food-processing firms' value chain activities.

Having examined the situation of the Polish S&T system in Chapter 5, it is striking to see that food-processing firms have not abandoned their domestic sources of knowledge for keeping-up with new production and product technologies. However it is still difficult to interpret these figures as a presence of an NSI within the food-processing industry. It can be seen rather as an indication of difficulties food-processing firms face in getting involved in knowledge networks with foreign partners due to major differences in their knowledge bases.

In summary, the literature and the descriptive analysis of Polish data in the sample lead us to expect a strong tendency of emerging market firms to establish links with foreign partners, and LMT industries are clearly no exception to this. In addition, the development of domestic links in production and distribution networks is also observed.

6.4 CONCLUSION

This chapter analysed the evolution of networks of Polish food-processing and clothing industries, and presented the developments in the two industries in terms of networks. With respect to network types that were frequently used by Polish firms in these industries, it can be concluded that the relations of clothing and food-processing firms evolve in different patterns over the transition years. Clearly, food-processing firms established *more* knowledge networks than clothing firms, while clothing firms established *more* production networks than food-processing firms over the transition years. Transition appears to be a decisive turning point for Polish LMT firms with respect to the emergence of relationships.

All network types show an increasing trend over the transition years in both industries. This increase in the number of relationships can be taken as a relative indicator of positive changes towards *networking* by emerging market firms in both industries. The main jump in the number of relationships is observed in the late 1990s (for all network

types). A remarkable increase in the number of relationships within distribution networks started in the mid-1990s in the clothing industry and in the late 1990s in the food-processing industry. Also based on my interviews with firms, during the transition years a gradual awareness of distribution networks as an important tool not only for improving business but also for knowledge transfer among agents in a business / production network seems to have started among LMT firms.

Chapter 7 NETWORK CHARACTERISTICS AND LEARNING MECHANISMS EXTERNAL TO THE FIRM

7.1 INTRODUCTION

This chapter is concerned with the inter-organisational level of the analysis in the research model (Figure 4.1). Based on the analytical framework (Chapter 3), this chapter aims to single out network characteristics that most significantly differentiate the learning mechanisms external to the firm. Three domains of networks characteristics that may distinguish learning mechanisms external to the firm were identified in the literature survey (Chapter 4): characteristics of the relationship, the characteristics of the partner involved in the relationship and the characteristics of the knowledge transfer during the relationship.

This chapter presents the results of the empirical research conducted on the sample of 467 relationships of Polish food-processing and clothing firms. A predictive model of learning mechanisms external to the firm was specified and estimated for this dataset, namely the Learning Model (LM). A multinomial logistic regression (MLR) model of learning propensity of firms in networks was used in order to distinguish which network characteristics better explain different learning mechanisms in these networks.

After a brief overview of the research questions examined in this chapter (section 2), section 3 will present the learning models (LMs) adopted in this empirical chapter with their specific predictors. The descriptive statistics of the variables are described in section 4, followed by a presentation of the estimation results of MLR analysis (section 5). Section 5 also includes a sub-section for each LM that discusses the most significant results in the light of the evidence from the previous research and finally section 6 concludes.

7.2 RESEARCH QUESTIONS

The research question this chapter aims at answering is “How does learning take place externally through networks in food-processing and clothing industries in Poland?” The sub-research questions that were addressed using the MLR model in this chapter are:

1. How do network characteristics affect learning mechanisms external to the firm?

2. To what extent does the effect of network characteristics on learning mechanisms external to the firm differ between food-processing and clothing industries?

The first sub-question concerns the main effects of network characteristics on learning external to the firm through LM. The second sub-question highlights the fact that the differences in learning mechanisms external to the firm may be the result of industry differences and is examined through an interaction model of learning (I/LM).

7.3 ESTIMATING THE LEARNING MODEL

This section first describes the LMs that were estimated using MLR. The variables used in this chapter are discussed in detail in section 4.5.1 of Chapter 4. The dependent variable, drawn from the learning literature (i.e. Malerba 1992, and von Tunzelmann and Wang 2007), was ‘learning mechanisms external to the firm’ (Y_i), where:

$Y_i = 1$ if there is learning from knowledge spillovers during the relationship,
 $Y_i = 2$ if there is learning from advances in S&T and education during the relationship,
 $Y_i = 3$ if there is learning by interacting during the relationship,
 $Y_i = 4$ if there is no learning during the relationship.

The independent variables were composed of the network characteristics (i.e. the particular features attributed to the relationship, to the partner in the relationships and to the knowledge transfer process within this relationship). The other regressors included a constant, an industry variable as control variable, time variable, five characteristic of the relationship and the partner, and three characteristic of knowledge transfer process in the relationship. Industry and time variables were included in all the models. All of them were expected to have effect on learning in networks (for descriptions of the variables, see Table 4.10 in section 4.5.1.3). Specifically, the variables are as follows:

Control variable: Industry (INDUSTRY),

Time variable: Time period the relationship started or took place (PERIOD);

Independent variables for:

Characteristics of the relationship and the partner: Network type (NETYPE), Initiator of the relationship (INITIATOR), Continuity of the relationship (CONTINUITY), Level of formality in the relationship (FORMALITY) and Geographical origin of the partner (ORIGINPARTNER);

Characteristics of knowledge transfer within the relationship: Direction of the knowledge transfer in the relationship (DIRECTION), Content of the knowledge transfer in the relationship (CONTENT), Mobility of people during the relationship (MOBILITY).

Two MLR models were specified to assess factors affecting learning external to the firm: The first model looked solely at the *main effects* of networks characteristics on learning mechanisms external to the firm in the Polish food-processing and clothing firms. The second model looked at the *effects of interaction variables* on learning mechanisms external to the firm that account for heterogeneity across firms in the two industries studied. Estimations were carried out using the full sample (i.e. without separating the dataset into two industries). The sample characteristics with respect to the independent variables and their descriptive statistics are discussed in section 7.4 below. The LMs to be estimated by MLR analysis are reproduced below with the relevant independent variables for network characteristics:

Learning Model

$$\begin{aligned} \log (\text{Prob}(\text{EXTLEARN}=j) / \text{Prob} (\text{EXTLEARN}=4)) &= \log (p_{ij} / p_{i4}) \\ &= \alpha_{j0} + \beta_{j1} \text{NETYPE} + \beta_{j2} \text{GEORIGIN} + \beta_{j3} \text{INITIATOR} \\ &\quad + \beta_{j4} \text{CONTINUITY} + \beta_{j5} \text{FORMALITY} + \beta_{j6} \text{DIRECTION} + \beta_{j7} \text{CONTENT} \\ &\quad + \beta_{j8} \text{MOBILITY} + \theta_{j1} \text{INDUSTRY} + \theta_{j2} \text{PERIOD} \quad (\mathbf{LM}) \end{aligned}$$

According to this model (LM), the log odds-ratio is α_{j0} for a formal, one-off, arm's length relationship initiated by domestic partner in which market-related knowledge was transferred bi-directionally without the presence of mobility of people between partners during the relationship. The coefficients β_{jk} measure the effect of network characteristics on the relative likelihood that learning external to the firm occurs via a particular mechanism. The θ_{jk} coefficients allow me to assess industry-related and temporal effects.

Industry - Interaction Model of Learning Mechanisms External to the Firm

$$\begin{aligned} \log (\text{Prob}(\text{EXTLEARN}=j) / \text{Prob} (\text{EXTLEARN}=4)) &= \log (p_{ij} / p_{i4}) \\ &= \alpha_{j0} + \beta_{j1} \text{NETYPE} + \beta_{j2} \text{GEORIGIN} + \beta_{j3} \text{INITIATOR} \\ &\quad + \beta_{j4} \text{CONTINUITY} + \beta_{j5} \text{FORMALITY} + \beta_{j6} \text{DIRECTION} + \beta_{j7} \text{CONTENT} \\ &\quad + \beta_{j8} \text{MOBILITY} + \theta_{j1} \text{INDUSTRY} + \theta_{j2} \text{PERIOD} \\ &\quad + \gamma_{j1} \text{INDUSTRY} * \text{PERIOD} + \gamma_{j2} \text{INDUSTRY} * \text{NETYPE} \\ &\quad + \gamma_{j3} \text{INDUSTRY} * \text{GEORIGIN} + \gamma_{j4} \text{INDUSTRY} * \text{INITIATOR} + \\ &\quad + \gamma_{j5} \text{INDUSTRY} * \text{CONTINUITY} + \gamma_{j6} \text{INDUSTRY} * \text{FORMALITY} \\ &\quad + \gamma_{j7} \text{INDUSTRY} * \text{DIRECTION} + \gamma_{j8} \text{INDUSTRY} * \text{CONTENT} \\ &\quad + \gamma_{j9} \text{INDUSTRY} * \text{MOBILITY} \quad (\mathbf{I/LM}) \end{aligned}$$

In the interaction model of learning, all the coefficients are the same as in LM, except the interaction terms, γ_{jk} , which allow the degree of network characteristics to vary with industry differences.

These multinomial logit models for learning in networks have four possible outcomes, and hence four probabilities:

$$\begin{aligned} p_{i1} &= \Pr(Y=1) = \Pr(\text{learning from knowledge spillovers}) \\ p_{i2} &= \Pr(Y=2) = \Pr(\text{learning from advances in S\&T}) \\ p_{i3} &= \Pr(Y=3) = \Pr(\text{learning by interacting}) \\ p_{i4} &= \Pr(Y=4) = \Pr(\text{no learning}) \end{aligned}$$

In this analysis, using $Y=4$ (i.e. no learning during the relationship) as the ‘reference outcome’, the log-odds ratios¹⁵⁵ of these probabilities in each model will yield three logit functions (section 4.6.4.1), as shown below:

$$\begin{aligned} \text{logit 1: } (\log(p_{i1} / p_{i4})) &= \log [\Pr(\text{extlearn} = \text{from spillovers}) / \Pr(\text{extlearn} = \text{no learning})] \\ \text{logit 2: } (\log(p_{i2} / p_{i4})) &= \log [\Pr(\text{extlearn} = \text{from advances in S\&T and education}) / \Pr(\text{extlearn} = \text{no learning})] \\ \text{logit 3: } (\log(p_{i3} / p_{i4})) &= \log [\Pr(\text{extlearn} = \text{by interacting}) / \Pr(\text{extlearn} = \text{no learning})] \end{aligned}$$

These logit functions mean the probability of ‘learning from knowledge spillovers’, ‘learning from advances in S&T and education’ and ‘learning by interacting’ were compared against the probability of the reference outcome ‘no learning’.¹⁵⁶ This means that the coefficients and odds-ratios calculated in the analysis represent deviations from ‘no learning during a relationship’ and that the other three learning mechanisms were not directly compared with each other. The four outcomes differ qualitatively and one of the outcomes does not necessarily represent an intermediate point between the other three outcomes.

Results are presented in Tables 7.4 and 7.5. There are three sets of results for each logit function in the LMs concerned. Before discussing the results, descriptive statistics of the variables are briefly explained.

7.4 DESCRIPTIVE STATISTICS

¹⁵⁵ As explained in section 4.6.4.2, odds-ratio is defined as the *ratio* of the probability of outcome Y_i , to the probability of the chosen reference outcome (in this case $Y=4$).

¹⁵⁶ Hence, the first logit function compares the ratio of the probability of “learning by knowledge spillovers” to the probability of “no learning” with parameter estimates $(\log(p_{i1} / p_{i0}))$ and so on.

This section explores the descriptive statistics of the variables used in the abovementioned LMs. Because all the variables used are categorical, descriptive statistics are largely limited to crosstabulations and chi-square tests of independence. Unlike the numeric variables, there is no reliable measure (that is similar to Pearson r) for correlation between categorical variables.¹⁵⁷ Following Tabachnick and Fidell (2007) and Petrucci (2009), the possibility of high multicollinearity between independent variables is controlled through checking for standard errors of the variables that are greater than 2 after the models are run.

To eliminate any concern with regard to a possible correlation between the primary independent variable NETYPE and the other independent variables that explain network characteristics, the LM with the variable NETYPE was compared with the LM without the variable NETYPE. The direction of the coefficients did not change in the LM without NETYPE when compared to the LM with NETYPE. There were slight changes in the magnitude and the significance of the variables MOBILITY and INDUSTRY respectively.¹⁵⁸ However, the information on NETYPE, which is a ‘clinically important’ variable for this research, was lost altogether. The effects of INDUSTRY variable are captured through models with interaction variables in section 7.5.2. Moreover, a comparison of log-likelihood ratios for models with and without the variable NETYPE showed statistically significant improvement with the addition of this variable, $\chi^2(6, 467) = 114.37, p < 0.001$ (a highly significant probability value), indicating that NETYPE, as a variable, reliably predicts learning mechanisms external to the firm. So, I prefer LM with NETYPE to LM without NETYPE. The comparative results are displayed in Table F.4 in Appendix F.

In the rest of this section, first the distribution of relationships in the dataset by the dependent and independent variables in the LMs is explored. Second, the association

¹⁵⁷ The symmetric measures in crosstabulations for categorical variables (Phi coefficient, Cramer’s V and Contingency coefficient) “give some sense of the strength of the association” between variables, yet “they do not, in general, have an intuitive interpretation” (SPSS version 17). Moreover, *Phi coefficient* is used only in 2x2 crosstabulations and *Cramer’s V* is re-scaling of Phi coefficient while with *contingency coefficient* “it is difficult to compare the association among variables among different size tables”, because “unfortunately, the maximum value of contingency coefficient varies with table size” (Scanlan, C.L., accessed August 2011, http://www.umdj.edu/idsweb/idst6000/nonparametric_analysis.pdf; see also SPSS version 17).

¹⁵⁸ The effect of NETYPE variable on INDUSTRY raises questions of whether this control variable is a potential ‘confounder’ of NETYPE. This is investigated in section 7.5.1.

between the dependent variable and the independent variables in the LMs is discussed to verify the model building.

7.4.1 Variables of Network Characteristics

Table 7.1 presents the frequencies of relationships related to the variables of network characteristics as discussed extensively in Chapters 3 and 4 (i.e. characteristics of the relationship, characteristics of partners and characteristics of knowledge transfer within the relationship). Table 7.1 also compares the frequencies of relationships across the food-processing and clothing firms. On all characteristics except geographical origin of partner and content of knowledge transfer within the relationship, the two industries have fairly similar pattern, confirming a homogenous sample.

According to the distribution of relationships, Polish food-processing and clothing firms appear to be the main initiators of their relationships (62.5% of total relationships; 67.2% and 59.2% of relationships pertaining to industries respectively). The relationships they established between 1989 and 2001 are dominantly formal (76.4% of total relationships, 81.5% and 72.8% of relationships pertaining to industries respectively), and slightly more than half of them are frequent (i.e. occur constantly and/or continuously). The knowledge transfer in these relationships is dominantly uni-directional (82% of total relationships, 80% and 83.5% of relationships pertaining to industries respectively), and approximately 40% of the relationships have mobility of people between partners (39% of total relationships, 40.5% and 38% of relationships pertaining to industries respectively).

The relationships of Polish food-processing and clothing firms differ with respect to the content of knowledge transferred and to the geographical origin of partners. In their relationships, food-processing firms are interested in transferring a variety of knowledge as compared to clothing firms, which strongly focused on production-related knowledge (52.2% of relationships of clothing firms). Also, food-processing firms transfer technology-related knowledge through their relationships twice as high than clothing firms (33.8% of relationships of food-processing firms versus 16.9% of relationships of clothing firms). In a similar way, clothing firms have established relationships with foreign partners (64% of their relationships), whereas food-processing firms are more interested in establishing relationships with both foreign and

domestic partners, with slightly more relationships established with domestic as compared to foreign partners (52% and 48% respectively).

Table 7.1 Distribution of relationships by industry type and by variables of network characteristics and the non-parametric test results of these variables

	Total relationships			Industry type (INDUSTRY)						Pearson Chi-Square Test (Asymp. Sign. 2-sided): INDUSTRY TYPE vs (VARIABLE)
				Relationships of Food-			Relationships of Clothing			
	count	%	Chi-square test (Asymp. Sig.)	count	%	Chi-square test (Asymp. Sig.)	count	%	Chi-square test (Asymp. Sig.)	
Sample size	467	100.0		195	41.8		272	58.2		
Time period (PERIOD)			0.000***			0.000***			0.000***	0.025**
late 1990s	262	56.1		117	60.0		145	53.3		
mid-1990s	132	28.3		58	29.7		74	27.2		
early 1990s	73	15.6		20	10.3		53	19.5		
Initiator of the relationship (INITIATOR)			0.000***			0.000***			0.002***	0.079*
the firm	292	62.5		131	67.2		161	59.2		
the partner	175	37.5		64	32.8		111	40.8		
Level of formality in the relationship (FORMALITY)			0.000***			0.000***			0.000***	0.028**
informal	110	23.6		36	18.5		74	27.2		
formal	357	76.4		159	81.5		198	72.8		
Continuity of the relationship (CONTINUITY)			0.000***			0.000***			0.000***	0.012**
continuous	245	52.5		103	52.8		142	52.2		
occasional / annual	90	19.3		48	24.6		42	15.4		
one-off	132	28.3		44	22.6		88	32.4		
Geographical origin of partner /network (GEORIGIN)			0.002***			0.519			0.000***	0.000***
foreign partner / international networks	267	57.2		93	47.7		174	64.0		
domestic partner / national networks	200	42.8		102	52.3		98	36.0		
Direction of knowledge transfer (DIRECTION)			0.000***			0.000***			0.000***	0.338
uni-directional	383	82.0		156	80.0		227	83.5		
bi-directional	84	18.0		39	20.0		45	16.5		
Content of knowledge transfer (CONTENT)			0.000***			0.000***			0.000***	0.000***
technology-related	112	24.0		66	33.8		46	16.9		
production-related	201	43.0		59	30.3		142	52.2		
business & quality management-related	109	23.3		50	25.6		59	21.7		
market-related	45	9.6		20	10.3		25	9.2		
Mobility of people in the relationship (MOBILITY)			0.000***			0.008***			0.000***	0.563
there is mobility	182	39.0		79	40.5		103	37.9		
there is no mobility	285	61.0		116	59.5		169	62.1		
Learning mechanisms external to the firm (EXTLEARN)			0.000***			0.000***			0.000***	0.000***
learning from knowledge spillovers	125	26.8		55	28.2		70	25.7		
learning from advances in S&T	109	23.3		67	34.4		42	15.4		
learning by interacting	157	33.6		46	23.6		111	40.8		
no learning / no awareness of learning	76	16.3		27	13.8		49	18.0		

Source: Own dataset, SPSS version 17.0

Asymptotic significance of the Chi-square tests of each variable for all firms, food-processing firms and clothing firms are also presented in Table 7.1. All the variables of network characteristics are statistically significant at 1% level for all firms. The variable ‘geographical origin of partners’ (GEORIGIN) is statistically significant at 1% level for clothing firms and yet not significant for food-processing firms.

Moreover, Table 7.1 displays the Pearson chi-square test results for the cross-tabulations between the industry type and each variable of network characteristics. There are associations between industry type and the variables ‘geographical origin of

partner' and 'content of knowledge transfer' at 1% level, between industry type and the variables 'formality' and 'continuity' of the relationship at 5% level, and between industry type and the variable 'initiator' of the relationship at 10% level; indicating there are differences between industry types with regard to these network characteristics with strong, confirmative and suggestive evidence respectively. Yet, there is no association between industry type and the variables 'direction of knowledge transfer' and 'mobility of people' in the relationship; indicating there are no differences in the distribution of categories of these variables among industry type.

With regard to the distribution of relationships by dependent variable, Table 7.1 shows that there is fairly equal distribution of learning mechanisms external to the firm in the dataset: 26.8% of total relations lead to learning from knowledge spill overs, 23.3% lead to learning from advances in S&T, and 33.6% lead to learning by interacting. Only 16.3% of total relations experience no learning.

The distribution of food-processing firms' relationships by learning mechanisms is similar to that for total relations, with significance attributed to learning from advances in S&T (34.4%) more than learning from knowledge spill overs (28.2%) and learning by interacting (23.6%). Learning in clothing firms' relationships, on the other hand, occurs by interacting in 40.8% of the relationships and by knowledge spill overs in 25.7%. This is hardly surprising, because the definition of 'learning by interacting' in this research as adopted from the literature (i.e. learning by actually interacting with upstream suppliers or downstream customers, users, and with other firms/organisations in the industry, Table 2.2, section 2.3.2.2) is expected to associate with the GVCs/GPNs of the upgrading literature (section 3.4.1). However, surprisingly, no learning happened in slightly more relationships (18%) of clothing firms than learning from advances in S&T (15.4%).

The non-parametric chi-square test result of the dependent variable (EXTLEARN) and its Pearson chi-square test result respectively show that this variable is statistically significant at 1% level and it is associated with the industry type, indicating that the two industries differ in terms of learning mechanisms external to the firm.

As Table 7.2 displays, Polish food-processing and clothing firms differ with respect to the number of relationships per firm in each learning mechanism. In general, the number of relationships per firm where firms learn in one way or the other dramatically increases from early 1990s to late 1990s. Moreover, the growth rate of number of relationships per firm in each period is higher for Polish food-processing firms than for Polish clothing firms (the last row). The distribution of dependent variable by independent variables of network characteristics can be found in Table F.5 in Appendix F, as part of the descriptive statistics of all the variables used in the MLR analysis in this chapter. A detailed distribution of dependent variable by network types in all firms as well as by industry type can also be found in Table F.1 in Appendix F.

Table 7.2 Number of relationships per firm over time by learning mechanisms external to the firm and by industry type

	Total relationships				Industry type (INDUSTRY)							
					Relationships of Food-processing firms				Relationships of Clothing firms			
	early 1990s	mid-1990s	late 1990s	Total	early 1990s	mid-1990s	late 1990s	Total	early 1990s	mid-1990s	late 1990s	Total
Learning mechanisms external to the firm (EXTLEARN)												
learning from knowledge spillovers	1.1	2.6	4.1	7.8	0.5	2.5	3.9	6.9	1.8	2.6	4.4	8.8
learning from advances in S&T	0.5	2.1	4.3	6.8	0.3	2.6	5.5	8.4	0.8	1.5	3.0	5.3
learning by interacting	2.0	2.3	5.5	9.8	1.1	0.8	3.9	5.8	2.9	3.9	7.1	13.9
no learning	0.9	1.3	2.5	4.8	0.6	1.4	1.4	3.4	1.3	1.3	3.6	6.1
Total	4.6	8.3	16.4	29.2	2.5	7.3	14.6	24.4	6.6	9.3	18.1	34.0

Source: Own dataset, SPSS version 17.0

In the Polish food-processing industry, around 7 and 8.5 relationships per firm, respectively, lead to learning from knowledge spillovers and advances from S&T respectively while in the Polish clothing industry almost 14 and 9 relationships per firm, respectively, lead to learning by interacting and learning from knowledge spillovers. Learning from advances in S&T during relationships does not play as significant role for the Polish clothing firms as for the Polish food-processing firms. Similarly, the number of relationships per firm in which learning by interacting occurred was low for the Polish food-processing firms; as a matter of fact, it fell 38% during mid-1990s compared to early 1990s, before increasing around 80% in the late 1990s. This has clear links with the dominance of knowledge networks in Polish food-processing firms and that of production networks in Polish clothing firms (Chapter 6).

The number of relations where Polish food-processing firms do not learn is considerably lower than that of Polish clothing firms, and it does not change since the

mid-1990s for the Polish food-processing firms, while it triples in the late 1990s compared to early and mid-1990s for the Polish clothing firms. This indicates a tendency of the latter to learn less during the relationships they were involved in since 1998 (i.e. time of economic crisis). The analysis results in Chapter 8 will shed light on whether this is because of the negative impacts of 1998 economic crisis and falling output levels in the Polish clothing industry after 1999 (Chapter 5), or if it is an indication of increasing competences of Polish clothing firms by means of internal learning mechanisms.

7.4.2 Associations between dependent and independent variables

As explained in model building in section 4.6.4.3, cross-tabulations of the dependent variable versus the independent variables were examined carefully for univariable analysis of each variable (see Table F.5 in Appendix F).

Table 7.3 Pearson Chi-Square test results for cross-tabulations between the dependent and each independent variable used in Learning Models

Test Statistics: Pearson Chi-Square			
EXTLEARN versus independent variables	Value	df	Two-sided Asymp. Sig. (p)
INDUSTRY	28.903	3	0.000
PERIOD	11.477	6	0.075
NETYPE	221.737	6	0.000
INITIATOR	61.717	3	0.000
GEORIGIN	7.351	3	0.062
CONTINUITY	88.398	6	0.000
FORMALITY	46.959	3	0.000
DIRECTION	25.139	3	0.000
CONTENT	132.299	9	0.000
MOBILITY	60.764	3	0.000

Source: Own dataset, SPSS version 17.0

As suggested by Hosmer and Lemeshow (2000), particular attention is given to zero cells. Examining the cross-tabulations displayed a zero cell between *distribution networks* category of the variable NETYPE and *learning from advances in S&T* category of the variable EXTLEARN, which in turn indicates the need for the category of *distribution networks* to be merged into the closest network type. For a sound decision, multiple correspondence analysis (MCA) was conducted to see the associations between network types, learning mechanisms external to the firm and firm-level upgrading. MCA results reveal that production and distribution networks within the variable ‘network type’ are better treated as one category than two separate categories. So, the MCA results suggested merging of these two categories, which in

turn collapsed the number of categories of NETYPE from 4 to 3 (The Figure F.1 in Appendix F.1): The lower the number of categories, the better the MLR analysis results. In addition, MCA results suggest the use of AL, no learning and no contribution to upgrading categories of network type, learning mechanisms and contribution to upgrading respectively as reference categories. The information about the MCA and its results are displayed in Appendix F.1.

The Pearson Chi-square test results of dependent variable EXTLEARN versus each independent variable used in the LMs show that there is association between the dependent variable and all the independent variables used in the LMs, and that they are statistically significant at 1% level, except the variables ‘geographical origin of partner’ and ‘time period’ (at 10% level) (Table 7.3). The criterion to be a candidate for the multivariable model is for the variable to have a *p*-value (asymptotic significance of Pearson chi-square test, 2-sided) lower than 0.25 (i.e. $p\text{-value} < 0.25$) (Hosmer and Lemeshow 2000). All the independent variables used in the LMs met this criterion.

7.5 ESTIMATION RESULTS

This section will discuss the estimation results of the MLR analyses for LM and I/LM. Tables 7.4 and 7.5 below present the MLR results for three logit functions of learning from knowledge spillovers versus no learning during the relationship, learning from advances in S&T and education versus no learning during the relationship, and learning by interacting versus no learning during the relationship.

7.5.1 Learning Model

LM was estimated through MLR in two steps to predict learning mechanisms external to the firm in one of abovementioned four outcomes: First on the basis of five independent variables of characteristics of the relationship and the partner¹⁵⁹, and then with the addition of three independent variables of characteristics of knowledge transfer process within the relationship. The LM in the first step is called the ‘baseline

¹⁵⁹ With the exception of the variable ‘type of partner’, which was eliminated from the analysis on the basis of definitions of learning mechanisms external to the firm that implicitly cover the ‘type of partner’, as explained in detail in section 4.5.1.1. This way, the possibility of a correlation problem is prevented. Hence, the geographical origin of partner (ORIGINPARTNER) is the only characteristic of the partner left in the analyses.

learning model’, and, because the LM in the second step incorporates the rest of the network characteristics, it is called ‘the final learning model’.

The major question here was whether the variables for the characteristics of knowledge transfer within the relationship significantly enhance prediction of the outcome learning mechanisms external to the firm, given the prediction yielded by the baseline LM (with only the variables for the characteristics of the relationship and the geographical origin of partner). So, the baseline model will help us to evaluate the improvement in the final model, and the final model will check the predictive ability of the variables for the characteristics of knowledge transfer within the relationship after adjusting for the differences in characteristics of the relationship and partner.

These two steps of LM are reproduced as follows and the results of fitting both of these models are displayed in Table 7.4:

Baseline Learning Model: *LM with characteristics of the relationship and the partner only*

$$\begin{aligned} \log (\text{Prob}(\text{EXTLEARN}=j) / \text{Prob} (\text{EXTLEARN}=4)) &= \log (p_{ij} / p_{i4}) \\ &= \alpha_{j0} + \beta_{j1} \text{NETYPE} + \beta_{j2} \text{GEORIGIN} + \beta_{j3} \text{INITIATOR} + \beta_{j4} \text{CONTINUITY} \\ &\quad + \beta_{j5} \text{FORMALITY} + \theta_{j1} \text{INDUSTRY} + \theta_{j2} \text{PERIOD} \end{aligned}$$

Final Learning Model: *LM with added characteristics of the knowledge transfer within the relationship, or in other words LM as defined in section 7.3*

$$\begin{aligned} \log (\text{Prob}(\text{EXTLEARN}=j) / \text{Prob} (\text{EXTLEARN}=4)) &= \log (p_{ij} / p_{i4}) \\ &= \alpha_{j0} + \beta_{j1} \text{NETYPE} + \beta_{j2} \text{GEORIGIN} + \beta_{j3} \text{INITIATOR} + \beta_{j4} \text{CONTINUITY} \\ &\quad + \beta_{j5} \text{FORMALITY} + \beta_{j6} \text{DIRECTION} + \beta_{j7} \text{CONTENT} + \beta_{j8} \text{MOBILITY} \\ &\quad + \theta_{j1} \text{INDUSTRY} + \theta_{j2} \text{PERIOD} \end{aligned}$$

Both baseline and final LMs were estimated through stepwise method of backward elimination (i.e. some variables are eliminated by constraining their coefficients to zero). LMs that were estimated through stepwise method were preferred, because when the Final LM with zero restrictions (which means that one of the stepwise methods for selection of variables is used) was compared with the full specifications model without any restrictions imposed on its coefficients, the result showed that imposing the zero restrictions did not qualitatively affect the estimates of the coefficients that were not set to zero. In general, the log-likelihood of the models and the magnitude of the

coefficients have not changed, $\chi^2(6, 467) = 2.28, p > 0.250$, indicating that the model with full specifications was no better than the model with zero restrictions. The results of fitting full specifications model and the restricted model are displayed comparatively in Table F.6 in Appendix F.

7.5.1.1 Overall Model Fit

Before examining the estimates, the overall fit of both the baseline and final LM was assessed. As Table 7.A.4 (in Appendix G) displays, the χ^2 values of both models decisively reject the null hypothesis ($p < 0.001$), which means the models had greater joint explanatory power of independent variables than a ‘constant only’ model.

Comparison of log-likelihood ratios for both the baseline and final models showed statistically significant improvement with the addition of the variables of characteristics of knowledge transfer process within the relationship, $\chi^2(15, 467) = 73.91, p < 0.001$ (a highly significant probability value), indicating that these variables, as a set, reliably predict learning mechanisms external to the firm. So, naturally, I prefer final LM to baseline LM.

Moreover, the overall correct classification improved from 62% to 66% with the addition of these variables. Pseudo R^2 (McFadden)¹⁶⁰ for the final LM was 0.363, which improved from 0.302 for the baseline model, suggesting the variables in the final model explain 36% of the variability in learning outcomes in networks. Higher Pseudo R^2 (McFadden) for the final LM compared to the baseline LM also confirmed that the variables for characteristics of knowledge transfer process within the firm were important factors determining learning mechanisms external to the firm.

Both of the LMs “show no inordinately large parameters or standard errors. Therefore, there is no reason to suspect a problem with too many empty cells or with outcome groups perfectly predicted by any variables” (Tabachnick and Fidell 2007: 470). The possibility of a problem of empty cells was dealt with during model building process by

¹⁶⁰ As Borooah (2002:57) reports from the survey of pseudo- R^2 measures by Veall and Zimmerman (1996), in multinomial logit models, as a measure of effect size for a model, as compared to Nagelkerke and Cox and Snell tests, only the McFadden (1973) measure “seemed worthwhile”. Being a transformation of the likelihood ratio statistic, it is the closest approximation mimicking an R^2 in multiple linear regression. It is a measure bounded in between 0 and 1 (Borooah 2002: 57, Tabachnick and Fidell 2007: 460), and “values in the 0.2 to 0.4 range considered highly satisfactory (Henscher and Johnson 1981)” (Tabachnick and Fidell 2007: 460).

following suggestions of Hosmer and Lemeshow (see section 7.4.2). In addition, in these models none of the standard errors for parameters were exceedingly large (i.e. greater than 2), indicating no evidence for multicollinearity (Tabachnick and Fidell 2007).

The likelihood ratio tests of each estimated independent variable¹⁶¹ showed that each of the variables had some association ($p < 0.25$)¹⁶² with the outcome of learning mechanisms external to the firm, except the variable for time period, PERIOD (Table F.8 in Appendix F). PERIOD was neither significant ($p = 0.892$) nor a confounder¹⁶³ when added to the LM without zero restrictions (Table F.6 in Appendix F). Due to conducting a dynamic analysis, PERIOD was a ‘clinically important’ variable for this research and therefore was kept in the analyses (Hosmer and Lemeshow 2000). Unfortunately, none of the categories of the time period appeared to be statistically significant in either of the logit functions of LMs run, except when NETYPE was manually eliminated (in logit 2 of Table F.4 in Appendix F).¹⁶⁴ Moreover, the backward elimination stepwise variable selection method employed in SPSS resulted in the removal of the variable PERIOD in all LMs, except when introduced as an interaction variable with the variable of ‘industry type’ (INDUSTRY) (section 7.5.2.2).

According to the likelihood ratio tests of each estimated independent variable (Table 7.A.5), all the variables of characteristics of the relationship and the partner contributed to the baseline LM, except INDUSTRY ($p = 0.161$). However, INDUSTRY was another ‘clinically important’ control variable for this research and therefore was also kept in the analyses (Hosmer and Lemeshow 2000). In the final LM the likelihood ratio tests of

¹⁶¹ Likelihood ratio test assesses the significance of each variable. Note that the likelihood ratio of each estimated variable is calculated from the model containing only that variable.

¹⁶² In SPSS v17, $p < 0.10$ is default for likelihood ratio test for removal of variables during stepwise procedure. However, Hosmer and Lemeshow (2000:118) recommend to increase the value for entry / removal for forward entry / backward elimination stepwise variable selection method to $p_E < 0.25$ (E for entry) / $p_R > 0.25$ (R for removal), in order not to exclude important variables from the model due to too stringent choice of a value for entry/ removal. For this reason, for the models used in this research, the value for removal in backward elimination stepwise variable selection method was chosen according to their recommendation. In either way, the likelihood ratio tests of all the variables used in the final LM are statistically significant at least at 10% level, except for the variable PERIOD.

¹⁶³ A confounder is a variable that is associated with both the outcome variable and a primary independent variable (which is NETYPE in this study) (see Hosmer and Lemeshow 2000:70). Testing for confounding helps selection of control variables. If a potentially confounding variable is not identified as a confounder on the basis of the test, further inferences about the effect of primary independent variable on the outcome is made ignoring that variable. If the variable appeared to be a confounder, subsequent inferences are made controlling for that variable (Mickey and Greenland 1989: 125).

¹⁶⁴ However, that model without NETYPE was not preferred (see section 7.4).

each estimated independent variable showed that all the variables, this time including INDUSTRY,¹⁶⁵ are statistically significant and enhance the prediction of the outcome variable of EXTLEARN.

Hence, INDUSTRY was expected to be a potential confounder to the outcome variable EXTLEARN and the primary independent variable NETYPE. A correlation possibility between INDUSTRY and some of the independent variables that explain network characteristics was signalled in the descriptive statistics of network characteristics by INDUSTRY (Table 7.1). In order to assess whether there is a confounding effect due to INDUSTRY, a model without INDUSTRY was run and compared with the final LM without zero restrictions. Examining the results of Table F.10 in Appendix F, the significant changes in the estimated coefficients in most of the independent variables provided a clear evidence for INDUSTRY variable to be a confounder. Therefore, INDUSTRY was included in the final model (see Hosmer and Lemeshow 2000) and subsequent inferences were made controlling for INDUSTRY variable (Mickey and Greenland 1989).

As a result, based on the assessment of the models' overall fit above, final LM was preferable to baseline LM. Next, the estimates from the three logit functions of final LM with *restricted* specification were made using Table 7.4, which shows the regression coefficients, the statistical significance of Wald χ^2 tests and standard errors in parenthesis.¹⁶⁶

7.5.1.2 The Estimates

As mentioned in section 4.6.4.2 of Chapter 4, in logistic regression, estimation is done by the help of a measure of association called *odds ratio*. A positive (negative) coefficient on a variable implies that the *odds-ratio* increases (decreases) with an increase in the value of the associated variable (Borooah 2001:5, Greene 2008). It is interpreted as the 'relative risk' (Hosmer and Lemeshow 2000).

¹⁶⁵ It appeared that the significance of the variable INDUSTRY in the likelihood ratio test of each estimated variable improves in the final LM ($p=0.063$). This might be related to INDUSTRY being a confounder and indicates that adding the variables for characteristics of knowledge transfer process within the relationship in the final LM was important and provided a needed adjustment of the effect of INDUSTRY variable. In other words, the interaction model of learning might need to be statistically adjusted for other variables included in the model by checking potential confounding effects.

¹⁶⁶ The more detailed results with odds ratios and the 95% confidence intervals around them can be found in Appendix G (Table 7.A.4).

Before discussing the estimation results of the final LM, an examination of the estimation results of the baseline LM as presented in Table F.7 in Appendix F is instructive. In the absence of the variables pertaining to knowledge transfer process during a relationship, notable differences in the odds ratio of each learning mechanisms external to the firm were attributed to:

- the importance of *knowledge networks* in increasing the likelihood of learning from knowledge spillovers during the relationship by 2.6 times compared to arm's length relations,
- the importance of *foreign partner* in doubling the likelihood of learning from advances in S&T during the relationship compared with domestic partners, and
- the *continuous relations* in doubling the likelihood of learning by interacting during the relationship compared with one-off relationships.

These results are consistent with the expectations of knowledge networks revealing more of spillover effects during the relationships (section 3.2.3.2), of foreign partners being more influential in introducing new science and technological developments in the LMT industries (section 4.3.1.2), especially when the literature on economic transition suggests that technology transfer from the west has become the predominant vehicle for technological catch-up in CEECs (Hirschhausen and Bitzer 2000), and of continuous relations - particularly with suppliers and customer in the value chains / production networks - rather than intermittent or one-off relations leading to developing trust, and therefore, a basis for exchange of knowledge between partners (section 2.2.2). In other words, the results are consistent with the evidence in existing literature.

However, these effects disappear when the factors related to the knowledge transfer process in a relationship are included in the final LM. Since the overall fit of final LM improves significantly as compared to baseline LM, the addition of the variables related to the knowledge transfer process within the relationship will clearly contribute to the existing literature by expanding our understanding of how knowledge acquisition processes affect learning mechanisms external to the firm in the Polish LMT firms. The estimation results of the final LM are reported below.

a. Learning from knowledge spillovers versus no learning

The estimation results of Table 7.4 (second column) show that the geographical origin of the partner (GEORIGIN), the initiator, continuity and formality of the relationship (INITIATOR, CONTINUITY, FORMALITY) and the mobility of people during the relationship (MOBILITY) are the statistically significant factors that change the odds of the outcome learning from knowledge spillovers during a relationship the most.

In the final LM, I observe no difference between food-processing and clothing firms (i.e. INDUSTRY variable is not statistically significant) for the outcome learning from knowledge spillovers. Also, there is no distinguished significant effect of network types on learning from knowledge spillovers. Based on these most significant factors in final LM, three characteristics can be identified that affect the log odds-ratio of learning from knowledge spillovers to no learning during the relationship:

- Having mobility of people during the relationship;
- Continuous and informal relations that are initiated by the partner, and
- This partner being foreign partner.

Other things being equal, a relationship in which there is mobility of people is almost seven times more likely to lead to learning from knowledge spillovers than a relationship in which there is no mobility of people. Moreover, the odds of learning from knowledge spillovers during an informal relationship, other things being equal, are four and a half times greater than the odds during a formal relationship. These results suggest a strong association between learning from knowledge spillovers and informal relations that involve mobility of people, confirming the earlier findings of the literature on transfer of tacit knowledge.

The odds of learning from knowledge spillovers during a relationship with a foreign partner are three times greater than the odds with a domestic partner. In other words, other things being equal, a relationship with a foreign partner is more likely to spill over knowledge than a domestic partner. However, the variable INITIATOR has a negative coefficient with an odds ratio of 0.45 and with a 95 percent confidence interval (0.21,0.98), suggesting that a relationship initiated by the firm is almost one-half times as likely to lead to learning from knowledge spillovers as a relationship initiated by the partner. Put differently, other things being equal, learning from knowledge spillovers in

a relationship initiated by the partner is twice (1/0.45) more likely than a relationship initiated by the firm. In addition, continuous relations are around two and a half times more likely to lead to learning from knowledge spillovers, other things being equal, compared to one-off relationships.

b. Learning from advances in S&T and education versus no learning

The estimation results of Table 7.4 (third column) show that industry type (INDUSTRY), network type (NETYPE), the initiator and continuity of the relationship (INITIATOR and CONTINUITY), the direction and content of the knowledge transfer (DIRECTION and CONTENT) and the mobility of people during the relationship (MOBILITY) are the statistically significant factors that change the odds of the outcome learning from advances in S&T and education during a relationship the most. Based on these most significant factors in final LM, three characteristics can be identified that affect the log odds-ratio of learning from advances in S&T and education to no learning during the relationship:

- Being a food-processing firm,
- Having knowledge networks and favouring arm's length relations to production and distribution networks that are one-off relations and are initiated by the firm, and
- Having uni-directional transfer of knowledge during the relationship, preferably technology- and business & quality management-related knowledge and preferably through mobility of people during the relationship.

The estimation results for this outcome show that, other things being equal, knowledge networks are around four and a half times more likely to lead to learning from advances in S&T and education than arm's length relationships. Production and distribution networks, however, have negative coefficients with odds ratio of 0.14 and with accompanied 95 percent confidence interval (0.02, 0.77), indicating that the odds of learning from advances in S&T and education compared to no learning are, other things being equal, decreased by 86% in production and distribution networks as compared to arm's length relations. Seen the other way round, the odds of learning from advances in S&T and education in arm's length relations are seven (1/0.14) times greater than the odds in a production network.

When the firm initiates these relationships, learning from advances in S&T and education is almost three and a half times more likely to happen than when the partner initiates the relationship, other things being equal. Continuous relations also have negative coefficient with odds ratio of 0.3 and with accompanied 95 percent confidence intervals (0.10, 0.89), indicating that continuous relations are about one-third as likely to lead to learning from advances in S&T and education as one-off relationships. In other words, the odds of learning from advances in S&T and education in one-off relationships are almost three and a half ($1/0.3$) times greater than the odds in continuous relations.

When the knowledge transfer is uni-directional in these relationships, other things being equal, learning from advances in S&T is five times more likely to happen than when knowledge transfer is bi-directional. When the knowledge transferred is related to technology and business matters as well as quality management, other things being equal, the odds of learning from advances in S&T and education are five and around six times respectively greater than when it is market knowledge. These results are consistent with the fact that Polish food-processing and clothing firms were forced into improving their quality management in harmony with the new scientific advances in their specialised manufacturing area in order to meet international quality standards - an issue that is quite closely related to firm-level upgrading in the emerging markets. Relationships that involve mobility of people, other things being equal, are almost two and a half times more likely to lead to learning from advances in S&T and education than those without mobility of people.

The odds of learning from advances in S&T and education are almost two and half times more likely in Polish food-processing firms than in Polish clothing firms. As presented in Chapter 6, not only are 53% of the relationships established by Polish food-processing firms are knowledge networks, but also the distribution of knowledge networks by initiator of the relationship, direction and content of knowledge transfer and mobility of people in the relationship revealed percentages in favour of Polish food-processing than Polish clothing firms (see Tables 6.4, 6.8 and 6.9).

Table 7.4 Estimation results of MLR for learning mechanisms external to the firm

	Learning Model					
Variable	Learning from knowledge spillovers		Learning from advances in S&T and education		Learning by interacting	
Constant	-1.16	(0.74)	-4.12***	(1.06)	-1.76**	(0.78)
<u>Control variables</u>						
food-processing vs clothing industry	-0.58	(0.41)	0.81*	(0.43)	1.00**	(0.41)
<u>Characteristics of the relationship</u>						
knowledge networks vs arm's length relations	0.31	(0.56)	1.53***	(0.54)	-0.91	(0.75)
production and distribution networks vs arm's length relations	0.03	(0.54)	-1.99**	(0.88)	2.10***	(0.58)
the firm vs the partner initiates the relationship	-0.79**	(0.39)	1.19**	(0.53)	-0.11	(0.39)
continuous relations vs one-off	0.96**	(0.45)	-1.20**	(0.55)	0.44	(0.41)
occasional relations vs one-off	0.45	(0.52)	-0.20	(0.49)	0.00	(0.56)
informal vs formal relations	1.50***	(0.46)	0.24	(0.55)	0.20	(0.49)
<u>Characteristics of the partner</u>						
foreign partner vs Polish partner	1.11***	(0.43)	-0.07	(0.49)	1.23***	(0.42)
<u>Characteristics of the knowledge transfer during the relationship</u>						
uni-directional vs bi-directional know ledge transfer	-0.38	(0.42)	1.63***	(0.62)	0.47	(0.43)
technology-related vs market-related know ledge	-1.01	(0.66)	1.63**	(0.76)	-2.31***	(0.74)
production-related vs market-related know ledge	-0.15	(0.64)	1.11	(0.80)	-0.47	(0.67)
business and quality management-related vs market-related know ledge	0.23	(0.65)	1.73**	(0.81)	-0.63	(0.69)
there is mobility of people vs no mobility of people in the relationship	1.94***	(0.42)	0.83*	(0.47)	1.26***	(0.46)
No of observations	467					
Log Likelihood	-338.94					
LR Chi-Square	459.22					
Degrees of freedom	39					
Prob > Chi-Square	0.000					
Pseudo R2 (McFadden)	0.363					
Correct classification	66.2%					
Variable Selection Method	Stepw ise (backw ard elimination)					
Variable removed	PERIOD					
Reference outcome	No learning during the relationship					
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.						

Source: Own dataset, SPSS version 17.0

c. Learning by interacting versus no learning

The estimation results of Table 7.4 (fourth column) show that industry type (INDUSTRY), network type (NETYPE), the geographical origin of the partner (GEORIGIN), the content of the knowledge transfer (CONTENT) and the mobility of people during the relationship (MOBILITY) are the statistically significant factors that change the odds of the outcome learning by interacting during a relationship the most. Based on these most significant factors in final LM, three characteristics can be identified that affect the log odds-ratio of learning by interacting to no learning during the relationship:

- Being a food-processing firm,
- Having production and distribution networks with a foreign partner, and
- Favouring market-related knowledge transfer to technology-related knowledge through mobility of people during the relationship.

Other things being equal, the odds of learning by interacting in a relationship are almost three times greater for a Polish food-processing firm than for a Polish clothing firm. The odds of learning by interacting in production and distribution networks, other things being equal, are eight times greater than the odds in arm's length relations. Learning by interacting during a relationship with a foreign partner is almost three and a half times more likely to happen than with a domestic partner, other things being equal.

Mobility of people during a relationship is a significant factor in learning by interacting, with an odds ratio of three and a half. However, technology-related knowledge transferred during these networks is one-tenth (0.10) as likely to lead to learning by interacting as market-related knowledge, or in other words, other things being equal, transfer of market-related knowledge during these relationships is ten (1/0.10) times more likely to lead to learning by interacting in these networks than technology-related knowledge transfer.

7.5.1.3 Discussion and inferences

The examination of Table 7.4 and the examination of the estimated odds ratios and their confidence intervals in Table F.7 in Appendix F provided us with the information about

what the most important and influential network characteristics for different learning outcomes in networks were.

Network type

The results with regard to the association between learning mechanisms external to the firm and network types are consistent with the MCA results in Appendix F.1 (Figures F.1 and F.2). There is no statistically significant effect of network type on learning from knowledge spillovers, suggesting that knowledge may spill over in any type of network in the same positive way (i.e. vertical, horizontal or market spillovers). This evidence is surprising, since it is expected knowledge networks would be the major source of knowledge spillovers for the emerging market firms in the form of technology transfers leading to reverse engineering. However, it is in line with the expectations of upgrading literature: knowledge spillovers are not necessarily confined to knowledge networks; on the contrary, production and distribution networks are expected to have significant spillover effects on the domestic firms (e.g., Ernst (1997) discusses ‘knowledge spillover effects’ from GPNs in section 2.5.2). To my best knowledge, knowledge spillover effects in GVCs/ GPNs were not captured through quantitative analysis elsewhere before. This result provides strong evidence that an increase in the likelihood of learning from knowledge spillovers during the relationship is not sensitive to network type, but to other characteristics of networks.

The association of knowledge networks and, when compared to production and distribution networks, AL relations is strongest with learning from advances in S&T and education.¹⁶⁷ This result is in line with Uzzi (1997) who discusses that such mixture of relations increases the adaptive capacity of the firms (section 3.2.2), in this case to new advances in S&T. Moreover, these findings for learning from advances in S&T and education partly confirm Mowery and Oxley (1995) that in an emerging market, technology transfer relies on arm’s length relations with technology suppliers and may have an effect on shaping the early stages of transition (time issue is to be detailed in

¹⁶⁷ When the LM was run by taking production and distribution networks as reference category, knowledge networks become thirtythree and a half and AL relations around seven times more likely to lead to learning from advances in S&T and education respectively. The increase in its log-odds ratio suggests that Polish LMT firms strongly rely on knowledge networks in order to follow new advances in S&T and learn from them when compared to both AL relations and production and distribution networks. Due to space restrictions, the estimation results of this model are not presented but available upon request.

relation to process upgrading in Chapter 8). In other words, although it is widely accepted in the literature that AL relations such as package technology purchases or licensing arrangements provide firms with some scope for learning, similar to Kim's (1999a) findings for Korean firms, they played a significant role for Polish LMT firms as a source of new knowledge to update their production processes, providing them initial upgrading opportunities, and subsequently opportunities to learn from these new technologies and advances in S&T. That is to say, the firms that are able to finance international technology purchase seek relationships that would introduce technological capability accumulation within the firm through dynamic organisational structure. In addition, it shows that these LMT firms have a certain, though modest, level of absorptive capacity that is required in order to be aware of the advances in S&T, have access to them (e.g. through importation) and use them (as suggested by Cohen and Levinthal 1989).

The negative effect of production and distribution networks on learning from advances in S&T and education confirms the GVC literature with regard to the limited sharing of technological knowledge between global buyers and Polish suppliers. This may be due to an effort by the global buyers to prevent the suppliers to upgrade to a level that will allow them to compete with the former (Schmitz 2006); alternatively, if the latter's level of technical competences is too high compared to low cost supplier countries, then the buyers will not interact with the suppliers in ways that require them to support suppliers with technological knowledge. These findings also show that Polish LMT firms are not deprived of knowledge networks that allow them to find out new advances in S&T; in fact, they make use of these networks in order to improve their knowledge stock and technological capabilities which is best reflected in their process upgrading (to be discussed in Chapter 8).

The association of production and distribution networks is strongest with learning by interacting.¹⁶⁸ This result confirms the discourse of the upgrading literature in Chapter 2 that there is learning in favour of local suppliers in GVCs/GPNs, though it extends this

¹⁶⁸ When the LM was run by taking production and distribution networks as reference category, production and distribution networks become twentyand a half times more likely than knowledge networks and around eight times more likely than AL relations to lead to learning by interacting. The increase in its log-odds ratio suggests that Polish LMT firms strictly rely on production and distribution networks in learning by interacting with customers, suppliers and other firms in their industry. Due to space restrictions, the estimation results of this model are not presented but available upon request.

discourse by showing that learning in production and distribution networks is not necessarily restricted to relations with global buyers (i.e. regarding other types of partners in the definition of learning by interacting). In addition, this result is in line with Szymanski *et al.*'s (2007) findings (based on interviews with Polish food-processing firms) that they learnt specific examples of management practices directly from international supply chain partners. They also found that "these companies identified the role of localised intelligence and networks in effectively understanding domestic consumers and establishing satisfactory supply chain relationships" (i.e. learning by interacting in distribution and supply networks respectively) (Szymanski *et al.*'s 2007: 446). These findings are not surprising when one recalls the type of partners associated with learning mechanisms external to the firm as well as the observations from my fieldwork (section 4.5.1.1 of Chapter 4, Table 4.8).

Geographical origin of the partner

Foreign partner is associated strongly with both learning from knowledge spillovers and learning by interacting when compared to no learning. This suggests that the knowledge emerging market firms are in need of resides most frequently in foreign partners. This result is supportive of the literature on spillovers from FDI that argues that the presence of FDI is an important source of technology transfer in emerging economies. In contrast to the controversial findings of empirical evidence on spillovers from FDI (section 5.2.6), this result identifies a positive learning effect from knowledge spillovers in relationships with foreign partners on Polish food-processing and clothing firms. However, it is worth remembering that in this research foreign partner include not only FDI (i.e. foreign firms/competitors with production facilities in Poland as well as foreign strategic investors with less than 50% share in Polish firms), but also organisations located abroad such as firms, universities, research institutes, and so on. Therefore, this finding extends our understanding of learning effects from knowledge spillovers during relationships not only with foreign competitors in the domestic market and foreign buyers in GVCs as a source of learning external to the firm, but also with foreign strategic investors (privatisation effect), universities and research institutes. Nevertheless, this result implies that there is 'knowledge transfer' from foreign partners in the form of positive spillovers in an emerging market. Whether they also contribute to the firm-level upgrading is a matter for Chapter 8.

The finding that learning by interacting is more likely during relationships with foreign partners than with domestic partners is compatible with the upgrading literature's argument that getting involved in GVCs/GPNs as suppliers of global buyers has facilitated learning from them by putting these suppliers on potentially dynamic learning curves observed by upgrading researchers and documented in various case studies (Hobday 1995a, Ernst 1997, Gereffi and Tam 1998, Schmitz 2006). At the same time, it indicates the lack of a production system at national/local level that would have been supportive of upgrading of the industries studied which had been weakened with the transformation and had not had a chance to recover at the time of this research. Moreover, as Chapter 5 discussed in detail, after transformation in 1989, the domestic sources were not sufficient to enhance or even to supplement either technologically backward situation of the industries or the lack of business related knowledge of the firms, and yet the result indicates the significance of vertical relationships with foreign raw material / ingredient suppliers and customers as source of knowledge for Polish food-processing and clothing firms.

These results can be interpreted according to the targeted markets of the industries studied (see section 4.3.1 of Chapter 4) as follows: In the traditional but relatively more technology-oriented sectors, like the food-processing industry, FDI has impacts on determining the level of national competition, as a fostering factor behind upgrading. Unintended spillovers and backward and forward linkages in the market shape the structural transformation of the sector. In the traditional and low technology sectors, like clothing, it is foreign links abroad (OEM relationships) that allow knowledge transfer – of production techniques, training, design and chain management.

Finally, our results for geographical origin of partners do not support the expectation of choice of foreign over domestic technology by emerging-market firms. Yet, at the same time, domestic partners for technology or education do not appear significant. This may indicate that Polish food-processing and clothing firms choose to establish relationships for educational purposes with, and acquire technology from both foreign and domestic partners, instead of choosing one or the other, as stressed by Bell and Pavitt (1993). Also, as Szymanski *et al.* (2007: 446) mentioned in the context of Polish food-

processing industry, “local knowledge was seen as a necessary asset, particularly in understanding the Polish food-processing culture, but not sufficient for success”.

Initiator of the relationship

Learning from advances in S&T and education is more likely to happen when the firm initiates the relationship rather than the partner. This shows willingness of the firm to find out the state-of-the-art technology and/or scientific developments in its industrial specialisation and keep up-to-date with the new developments. This result indicates that, while operating as production units in the socialist period, the firms quickly developed ‘linkage capabilities’ not only to get involved with but also source knowledge from partners that provide novel technologies and scientific knowledge. It also shows the willingness of the firm to be an active learner during the relationship; the firm initiates the relationship with a strategic goal of learning specific knowledge in the domain of the partner and therefore chooses the right partner that can provide it.

On the other hand, the odds of learning from knowledge spillovers reduce by almost 60% when the firm initiates the relationship. In general, learning from knowledge spillovers is more likely to happen when the partner initiates the relationship. It means that the partner is more willing to share knowledge than not, and therefore shares its knowledge openly with the Polish LMT firm. Based on the information gathered during my fieldwork, there are cases where the foreign partner chose a Polish clothing supplier that already had a CAD system in order not to deal with the prototyping of the design and focus on quality matters (i.e. allowing the supplier to have access to learn the means to improve the quality of its own products and production processes), or a Polish food-processing firm with strong market knowledge and distribution channel to overcome different kinds of market inefficiencies and facilitate the entry of the partner’s own brand into that market (i.e. allowing the Polish firm to have access to its marketing and distribution knowledge during its own process of market entry, which could be imitated by the Polish firm later on to enter in neighbouring markets).

A joint interpretation of the significance of a relationship with foreign partner on learning from knowledge spillovers (as discussed above) with this finding may indicate an important contribution to the spillover literature. A relationship that is *initiated* by a

foreign partner may mean the spillage of knowledge is more likely to happen than in the case of a domestic partner. This is not surprising given the lack of up-to-date and state-of-the-art knowledge of domestic partners; so, even if they initiate the relationship, most often they do not have much to offer to the firms even in the form of spillovers (see section 5.3 of Chapter 5). However, this result also tells us that if a foreign partner initiates the relationship, it will be less secretive of its technological knowledge, processes, and procedures leaving room to the firm to benefit from knowledge spillovers, provided that it controls the relationship (e.g., in GVCs/GPNs). This may indicate a situation where governance plays a role and the lead firm reveals as little as possible to be able to keep the firm under its control, as discussed in upgrading literature within the context of GVCs. It may also mean that the firm is rather passive and receptive of knowledge made available by the partner and need not work for making the most of the relationship with respect to useful knowledge spillovers. This may indicate low levels of absorptive capacity of the firm. In both cases, this result is compatible with the case studies on upgrading demonstrating that foreign partners (mostly customers/lead/buyer firms in GVCs that are at the same time horizontally-related firms to domestic supplier firms, especially when -as in this research- the latter are also OBMs in their domestic markets) are careful not to support transfer of knowledge more than the supplier firm needs for the quality production required (see section 2.5.2, Schmitz 2006). I observe this phenomenon particularly in the Polish clothing industry.

The initiator of the relationship is negatively associated with learning by interacting (i.e. in line with the GVC literature, the partner initiates the relationship) but this is statistically not significant. In the transition years, initiation by the firm is not observed mainly because of lack of linkage capabilities in production and distribution networks, which were centrally governed during socialist era (i.e. slow adaptation of the food-processing firms) and were later governed by the global buyers (e.g. for clothing firms). It is expected that only after developing significant network and network-related experience can firms move along the learning curve with skills necessary for knowledge acquisition from the partner. A follow-up research from early 2000 to today would help distinguishing level of improvement in the various type of capabilities of the emerging market firms (technological, linkage, organisational and so on).

Continuity of the relationship

Continuous relations are more likely than one-off relations to lead to learning from knowledge spillovers, relative to learning from advances in S&T and education where continuous relations decrease the odds of learning from advances in S&T and education by almost 70%. This first finding is in line with the findings of Inkpen (1998) and Kim and Inkpen (2005), who suggest that continuous relations create a higher level of interaction possibilities and therefore allow more knowledge about the partner, reduce uncertainty about the future behaviour of the partner, develop trust between the partners and establish a networking experience that decrease partner protectiveness of its knowledge; in other words, accessibility to partner's knowledge becomes higher, allowing spillovers to increase during the relationship (section 4.5.1.2).

This result suggests that developing a networking experience and trust between partners reduce partner protectiveness, which in turn plays a significant role for knowledge spillovers. Continuous relations represent higher level of interaction during the relationship, which leads to development of interpersonal communication and thereby to the development of more informal relations among the partners and more knowledge spillovers.

On the other hand, firms tend to learn from new advances in S&T and education through one-off type relationships, which are mostly technology acquisition packages, consulting services or contract R&D with universities / research institutes. In a way, this result seems to be in line with the initial assumption that emerging market firms are user or recipient - rather than being generator or creator - of scientific and technological knowledge by showing that Polish food-processing and clothing firms lack interest in continuous relationships for basic or applied research, but prefer relationships in which they can obtain the results of such research that are suitable for their industrial specification. One of the reasons, e.g. in the case of medium low-tech food-processing industry, is the lack of interest in costly long-term research investments. Similar to the clothing industry, in the food-processing industry, the focus is shifting from research to demand (as mentioned in section 1.2.2). Having said that, later, the analysis results will show that this is not necessarily the case.

Formality of the relationship

Informal relations are more likely than formal relations to lead to learning from knowledge spillovers during the relationship. This result indicates that what is important for learning from knowledge spillovers during a relationship is not the type of network the firm is involved in but the ability to establish informal relations in these networks that will allow firms to have recourse to knowledge spillovers. Moreover, not surprisingly, this result is in line with the literature on knowledge transfer. I have already found that continuous relations have significant positive effect on learning from knowledge spillovers, and the literature suggests that such relations allow room for the development of interpersonal communication, which leads to development of informal relations between partners with or without mobility of people. This in turn is expected to feed knowledge spillovers among the partners, which is the case in Polish food-processing and clothing firms.

Mobility of skilled people during the relationship

A striking result of this research concerns the consistently overwhelming effect of mobility of people on three groups of learning mechanisms external to the firm when all other postulated variables of network characteristics are held constant. This result shows that the emphasis on mobility of people in the earlier contributions on transfer of tacit knowledge (e.g., Polanyi 1967) remains timely and fundamental to understanding its importance not only as a mechanism for flow of tacit knowledge between partners in networks but also because of its impact on learning processes in these networks.

Learning from knowledge spillovers through labour mobility during the relationship supports the impact of FDI when the relationship is established with foreign partner. The results on learning from knowledge spillovers during a relationship are in line with the work on labour mobility as one of the spillover channels from foreign companies (Mowery and Oxley 1995, Günter 2005).

These findings are also consistent with the results of case studies on upgrading which frequently refer to the importance of mobility of people between global buyers and local suppliers in GVCs / GPNs– i.e. learning by interacting (see case studies in Schmitz 2004). Particularly in the GVCs/ GPNs of clothing industry, the mobility of people in a relationship with a foreign partner is frequently observed in differing forms, such as

‘technician’ of the global buyer firm who comes and stays in the company for months at a time or representatives of the global buyer who came for inspection of the Polish firm at the beginning of the relationship. During these visits, they make their demands clear with regard to technology and quality management. No evidence was found for the other direction of mobility (i.e. from the Polish supplier to the global buyer). This is part of the indirect forms of knowledge diffusion in GPNs called ‘learning facilitation’ by Ernst (1997) and observed in our results as a significant contributor to learning in networks.

Learning from advances in S&T and education is also more likely to happen through mobility of people. Examples include technology acquisition packages coming with specialists installing the new technology and training the employees in the firm, or consulting firms working with the employees of the firm to understand the dynamics of the company and help according to its idiosyncratic needs, or a joint product development project with a university requiring movement of people back and forth between the university laboratories and the manufacturing site of the firm.

So, the contribution of this research with the result of the variable ‘mobility of people during the relationship’ is twofold: First, the ability to generalise the learning effects from knowledge spillovers in any type of networks as long as they involve informal relationships and mobility of people within that relationship, and second the confirmation of the finding of the literature on knowledge transfer that mobility of people facilitates any learning mechanisms external to the firm.

Content of the knowledge transfer during the relationship

Content of knowledge transfer during the relationship affects learning from advances in S&T and education and learning by interacting significantly: Technology and business & quality management-related knowledge are more likely than market-related knowledge to lead to learning from advances in S&T and education while learning by interacting decreases by almost 90% when technology-related knowledge rather than market-related knowledge is transferred.

As widely discussed in sections 5.2.7 and 5.3 of Chapter 5, improving the out-dated technology and aligning with the international quality standards has been a matter of

survival for Polish firms after transformation. The large factories had already idle production capacities with old technology that created huge energy costs. Therefore, new investment in technology was more of cost-reducing technical change than production capacity expansion. With poor financial conditions, firms were initially interested in finding out the available newest technology that they can afford. With the loss of confidence in technology produced in the country (machine tool industry was also not in good shape), firms searched for foreign technology suppliers who provided extensive services during and after the purchase. This indicates first the technology dependence of Polish food-processing and clothing firms during the transition years, second the anticipation for continuation of this dependence in the years to come and third the interest of Polish firms in learning new advances in S&T through interaction between the personnel of the firm and the technology supplier firm, university or research lab within the technical support provided. As well as reducing the technological gap of the emerging market firms vis-à-vis international state-of-the-art technology, learning from advances in S&T prepared a ground for these firms to initiate their upgrading efforts in other areas.¹⁶⁹ In the literature, this stage of technological dependence is widely observed in the emerging market firms (Kim 1997, Dahlman and Fonseca 1987, Katz 1987).

Similarly, meeting the international standards¹⁷⁰ became a necessary condition for the Polish LMT firms if they intend to work with foreign customers in the short run and to export in the long run. At the beginning of the transition, Polish food-processing firms lost their export licences to Western markets due to strict regulations in health and safety standards, which served as strong incentive to promptly improve their hygiene and quality to the level of international standards (von Tunzelmann and Yoruk 2004). Moreover, although it is put as a prerequisite to the Polish clothing firms via their global buyers in GVCs/GPNs, in this research's sample of firms there is no evidence for support or assistance with the acquisition or implementation of the quality certificates by global buyers. This result is compatible with the findings of Quadros (2004). The firms in this sample develop linkages with consulting firms for the purpose of getting these certificates. A fair amount of investment is needed for increasing their standards,

¹⁶⁹ Analysis in Chapter 8 will shed more light on this issue.

¹⁷⁰ In food-processing, this means Hazard Analysis and Critical Control Point (HACCP) and global standards (ISO 9000).

including investments in new technology and equipment, training personnel and improving quality of raw materials (e.g., these standards forced food-processing firms to develop new cooperation types with the raw material suppliers or forced clothing firms to develop direct contact with foreign suppliers, introducing a new capability in ‘purchasing’ which these firms did not have during the socialist era). At the same time, having these certificates did not help improve the ‘technical’ collaboration between the global buyer and the supplier firm, as discussed in the context of the negative effect of production and distribution networks on learning from advances in S&T and education above (also, Quadros 2004).

These results suggest that emerging market firms, being the recipients of new advances in S&T rather than generators of it, are more likely to learn from these new advances in S&T through networks with sources of technology-related knowledge. Earlier (section 4.5.1.2), technology-related knowledge was classified as comprehensive of scientific and technological knowledge as well as knowledge on process technology. After transformation, efficiency has become a significant issue that required Polish firms to invest in the re-organisation of production facilities, improving training activities within the firm and introducing quality management procedures. Some of this information came as spillovers from partners, some was ‘demanded’ by partners during relationships, and some came from the market (e.g., consulting firms, accredited certification institutes, MBA courses by the branches of foreign universities). The realisation of these needs also pushed Polish LMT firms to find the right partners and learn from the new advances on S&T they readily provided. Technology, business and quality-related knowledge mainly comes from technology suppliers, universities, research institutes and specialised consulting firms, and this is consistent with the definition of learning from advances in S&T and education (section 4.5.1.1). At the same time, Polish LMT firms have more recourse to knowledge on management transferred through university academics, who provide short-term business and management certificate programmes through university departments or consulting firms.

In contrast to the upgrading literature that argues supplier firms follow new advances in production technologies by means of GVCs/GPNs that they are involved in (e.g., leasing of a specific machinery by the global buyer to the local supplier for the duration

of the production of a particular product), this result indicates that Polish firms have recourse to new advances in S&T through a variety of sources within knowledge networks and AL relations. At this point, it will be illuminating to look at the industry variable. Since food-processing firms are more likely to learn from advances in S&T during their relationships as compared to clothing firms, it can be assumed that these results are more representative of Polish food-processing firms than clothing firms, as upgrading for food-processing firms required a combination of technological and non-manufacturing areas. This interpretation of learning from advances in S&T (according to the technological developments in the industry) is compatible with the data from Central Statistical Office of Poland that is displayed in Table 5.7.

On the other hand, learning by interacting is more likely through relationships that transfer market-related knowledge than through those transferring technology-related knowledge. As mentioned in section 4.5.1.2, technological and marketing know-how is stickier than market-related knowledge (Simonin 1999b); although market knowledge has a tacit nature as well that influences firms' choices of entry modes to new markets (Johanson and Vahlne 1977). Hence, forward and backward vertical relationships with suppliers, customers, users, complementary firms and organisations in the same of related industries are valuable sources of market knowledge for Polish LMT firms, rather than technological knowledge. This result is compatible with the findings of Bazan and Navas-Aleman (2004), whose findings underline the importance of market-related knowledge, particularly in arm's length relations within Latin America (as opposed to captive GVCs with USA and European firms), although this analysis does not provide evidence about the geographical level at which learning by interacting in production and distribution networks is more likely through the transfer of market-related knowledge or technology-related knowledge. Moreover, not only the cautious approach of lead firms to transferring their technological knowledge (the basis of their core competence), but also the maturity of an industry such as clothing may be a reason for the lack of transfer of technology-related knowledge in GVCs/GPNs (cf. Kishimoto 2004). The transfer of market-related knowledge in GVCs/ GPNs, on the other hand, happens both voluntarily, when the supplier firm has accumulated substantial technological and production capabilities for CAD use, prototyping and so on, and involuntarily, through product specifications and designs sent by the lead firm for OEM.

Both transfers allow firms to have access to knowledge of current fashion with regard to product designs and to follow product market evolution in the world.

Direction of the knowledge transfer during the relationship

Direction of the knowledge transfer during a relationship is likely to affect learning from advances in S&T and education, relative to other learning mechanisms. Uni-directional transfer of knowledge in networks indicates the continuing legacy of the S&T system in the socialist era. New advances in S&T continued to be created in organisations other than Polish firms during transition years (including FDI). Relationships with these organisations allowed Polish firms to access these new advances, about which they were enthusiastic (as they initiate relationships that lead to learning from advances in S&T). However, being most often simply the recipients of knowledge means that these firms are still functioning within the dominant linear innovation model of socialist times and could not break their chains to develop capabilities to be part of the developments in S&T. This may be because of the nature of the industries chosen (compared to high-tech industries); however, the S&T system which is still full of discrepancies and therefore not only fails to meet the technological needs of the firms but also to integrate the firms into the process with smart funding policies (Chapter 5) also has an impact. As mentioned earlier, this reinforces persistent deficiencies in technological capabilities and shortage of knowledge sharing and generation activities by Polish firms in their relationships, and therefore it is no surprise that in the emerging markets context, learning from advances in S&T and education is more likely when there is one-way knowledge transfer between the partners rather than two-way (Radošević 1999b and c, 2004, Dyker 1997, 2004a, 2010). This result also explains why one-off relations are preferred for learning from advances in S&T and education: because the firm has very limited capability to improve the knowledge on new advances in S&T in cooperation, learning new advances in S&T from the partner during a relationship becomes a one-off activity. The ability to internalise this acquired knowledge (which can be taken as an indicator for technological capability ‘development’) is a matter for Chapter 8.

The sample does contain exception to this passive recipient role of the Polish LMT firm: Called farmer subcontracting, it is an activity that emerged in the transition years as a result of failures in the upstream food-processing industry (section 6.3.2). MNC

subsidiaries have taken a significant role through spillover effects in this development in two ways: By developing this subcontracting relationship (that involves a fair amount of cooperation and training of farmers to improve the quality of supply) themselves first, MNC food subsidiaries have been examples to Polish food-processing firms; and second MNC subsidiaries in agro-business supported this subcontracting relationship between the Polish food-processing firms and farmers by training the agronomists of the firms and collaborating in experimentations (in the specific use of their own products). This uni-directional knowledge transfer is from the agronomists in the firm to the farmers in the upstream. This relationship leads to experimentations and learning from application of new advances in agro-business in Polish food-processing firms.

Industry type

The findings show that industry effects are strongest when comparing the relationships that lead to learning from advances in S&T and education and learning by interacting with the relationships that lead to no learning (relative to learning from knowledge spillovers). Food-processing firms are more likely to learn from advances in S&T and education and learning by interacting than clothing firms.¹⁷¹ (There is no significant difference between food-processing and clothing firms with regard to learning opportunities that arise from knowledge spillovers during relationships).

On the one hand, this result is an indication that more learning opportunities arise for food-processing firms than clothing firms from networks with technology suppliers, universities, research institutes, laboratories, specialised consulting or intermediary firms for international technology transfer. As the results on network characteristics that affect learning from advances in S&T and education revealed above, knowledge networks with these types of partners are more a means for transferring scientific,

¹⁷¹ Despite efforts during the 1980s by Japan, West European countries and the US to develop full automation in the clothing industry, it is hard to automate all production stages in the clothing industry - particularly sewing, which continues to require experienced labour. Several projects in Japan, the US and Europe have ended up with other modest but generally useful innovations like automated seaming (Byrne, 1995) and specialized machinery like automated buttonholing or collar sewing. When CAD is considered as pre-assembly stage where design, grading and marking of patterns are prepared, in fact the only fully automated segment in the assembly stage is cutting (first introduced in the 1970s). Thus, the labour-intensive characteristics of the clothing industry remain, as the one-machine / one-operator configuration of the sewing stage has not been altered. However, most of the segments of the food-processing industry are suitable for employing automation in production processes (and in warehousing) than the clothing industry. This helps explain why technology transfer and the accompanying training by the technology provider is a significant source of learning in the food-processing industry but not in clothing.

technological, technical and quality management-related knowledge than market-related knowledge. Therefore, as discussed in sections 1.1.2 and 4.3.1.2, this is consistent with the shift in the nature of food-processing industry from low-technology to medium low-technology, manifesting itself in the increasing need for such collaboration to gain access to advances in S&T as early as possible, for instance to improve process technology and/or develop new product (as will be discussed in Chapter 8). Accessing market-related knowledge in food-processing industry, on the other hand, is supplemented by learning opportunities through interacting with suppliers, customers, users; complementary firms and organisations in the same or a related industry, most often through arm's length relations.

7.5.1.4 Summary

In summary, learning from knowledge spillovers is most likely to occur in continuous relations initiated by a foreign partner, who is involved in informal relations as well as mobility of people. Network type has no significant discriminating effect on learning from knowledge spillovers, which come from knowledge, production and market systems.

Learning from advances in S&T and education is most likely to occur in knowledge networks and arm's length relations where technology and business & quality-management-related knowledge are transferred through mobility of people. Apparently, when the firm initiates the relationship there is effective learning, which explains the uni-directional knowledge transfer during the relationship (this may be to the firm or from the firm as in the case of relations with farmers in the food-processing industry).

Learning by interacting is most likely to occur in production and distribution networks, particularly with foreign partners that involve mobility of people and transfer more market-related knowledge than technology-related knowledge.

7.5.2 Industry - Interaction Model of Learning Mechanisms External to the Firm

The crucial question in this section is how much of the differences in learning mechanisms external to the firm are due to *industry differences*. The independent variables that interact with INDUSTRY variable were checked following Hosmer and Lemeshow (2000) adding each interaction variable one at a time to the main effects LM

to assess their significance using a likelihood ratio test. This meant running regressions of eight separate models with interaction variables of industry type by variables of network characteristics.¹⁷² The results of the likelihood ratio test of the statistically significant industry interaction variables at 10% level were INDUSTRY*NETYPE ($p = 0.001$), INDUSTRY*CONTINUITY ($p = 0.021$) and INDUSTRY*MOBILITY ($p = 0.038$) (highlighted in italics in Table F.9 in Appendix F). The other industry interaction variables indicated no or weak association with the outcome variable, suggesting omitting these variables from the interaction model of learning (I/LM) (due to strict adherence to the conventional levels of statistical significance). Nevertheless, using researcher's discretion, due to the fact that INDUSTRY is the main comparison ground of this research, all interaction variables with INDUSTRY, except the interaction variable INDUSTRY*DIRECTION, are kept to create I/LM as specified in section 7.3.¹⁷³

In addition, these eight models were also used to find out whether INDUSTRY variable (which is a confounder, section 7.5.1) is also a moderator or an effect modifier.¹⁷⁴ Based on the results of the likelihood ratio tests for the significant interaction variables, I concluded that each of these models with statistically significant interaction variables is better than main effects LM.¹⁷⁵ Examining the significance of Wald χ^2 tests, it is observed that the direction of the estimates of the independent variables in I/LM does not show any difference from the estimates of main effects LM; however, the strength of the relations between selected independent variables and the dependent variable is affected, making the INDUSTRY variable a moderator (Baron and Kenny 1986) as well

¹⁷² Since the estimates of these eight models are not the main concern they are not presented here; however, the likelihood ratios of the interaction variables added are of concern and presented in Table F.9 in Appendix F.

¹⁷³ As Table 7.1 above shows the variable DIRECTION was strongly biased towards uni-directional transfer of knowledge in the dataset. This is true for both industries (as opposed to the variable FORMALITY, for instance, where the distribution of the variable is significantly different in the clothing industry compared to the food-processing industry). This means that this variable shows no significant difference across industries (Pearson Chi-square sig. 0.338). It is suspected that this bias of the variable DIRECTION might have caused unexpected singularities in the Hessian matrix, which in general requires either exclusion of some independent variables or merging of some categories. As a result, the interaction variable INDUSTRY*DIRECTION is excluded manually.

¹⁷⁴ A moderator (or an effect modifier) is a variable that interacts with an independent variable (Hosmer and Lemeshow 2000: 70) and "affects the direction and/or strength of the relation between an independent and a dependent variable" (Baron and Kenny 1986: 1174).

¹⁷⁵ INDUSTRY*NETYPE with $\chi^2(6, 467) = 22.64, p < 0.001$ (a highly significant probability value), INDUSTRY*CONTINUITY with $\chi^2(6, 467) = 14.10, p = 0.029$, and INDUSTRY*MOBILITY with $\chi^2(3, 467) = 8.58, p = 0.035$.

as a confounder. Therefore, the interpretations of any estimate of the odds ratio for NETYPE, CONTINUITY and MOBILITY will be made with reference to INDUSTRY type. The I/LM was also estimated through stepwise method of backward elimination.

7.5.2.1 Overall Fit

As Table 7.5 displays, the χ^2 value of I/LM decisively reject the null hypothesis ($p < 0.001$), which indicates higher joint explanatory power of independent variables in I/LM than a 'constant only' model. Comparison of log-likelihood ratios for LM and I/LM showed statistically significant improvement with the addition of industry interaction variables, $\chi^2(30, 467) = 51.46, p < 0.01$ (a significant probability value), indicating that interaction variables reliably predict learning mechanisms external to the firm. In other words, overall fit of I/LM is improved in comparison to LM (Table F.11 in Appendix F). Yet, this does not affect the validity of the results of LM, since the two models address two different questions: LM the question of how network characteristics affect learning mechanisms external to the firm, and I/LM the question to what extent these effects of network characteristics on learning mechanisms external to the firm *differ* between Polish food-processing and clothing industries. In other words, with regard to the INDUSTRY type variable, LM uses it as an independent variable to capture the effect of a particular industry directly on learning mechanisms external to the firm, while in I/LM, it is used as a moderating variable to distinguish the effect of a particular industry on the relationship between learning mechanisms external to the firm and the selected network characteristics.

The overall correct classification of the model was 68.5%. Pseudo R^2 (McFadden) value for the model was highly satisfactory at 0.404, suggesting that the variables explain 40% of the variability in learning outcomes in networks. None of the standard errors of the variables in I/LM appeared to be large enough (i.e. above 2) to warrant multicollinearity concerns (Tabachnick and Fidell 2007, Petrucci 2009). The likelihood ratio tests of both independent variables and the interaction variables show some association ($p < 0.25$) with the outcome learning mechanisms external to the firm, with exceptions of INDUSTRY*INITIATOR, INDUSTRY*CONTENT and INDUSTRY*GEORIGIN. They were also excluded from the model during backward

elimination stepwise variable selection process.¹⁷⁶ This meant that while these variables may exert a significant effect on the likelihood of a relationship leading to one of the learning mechanisms external to the firm (e.g., as in LM above), the INDUSTRY differences did not change this effect. In the following sections, the estimates from the three logit functions of I/LM were made using Table 7.5, which shows the regression coefficients, the statistical significance of Wald χ^2 tests and standard errors in parenthesis.¹⁷⁷

7.5.2.2 *The Estimates*

This section presents the estimates of a model when all the interaction variables related to INDUSTRY were run together (Table 7.5). That is to say, the INDUSTRY variable is used to control for the differences between Polish food-processing and clothing industries in I/LM. Below I examine the estimation results for each learning mechanism.¹⁷⁸

Learning from knowledge spillovers versus no learning: Table 7.5 (second column) presents the estimation results for the odds-ratio of learning from knowledge spillovers versus no learning for I/LM. The coefficients of the INDUSTRY interaction variables for the outcome of learning from knowledge spillovers are negative and marginally significant (i.e. at 10% level), differentiating industries studied with respect to NETYPE and CONTINUITY of the relationship. The results suggest that, other things being equal, Polish food-processing firms in production and distribution networks and in occasional/regular relations are *less* likely to learn from knowledge spillovers than Polish clothing firms. More precisely, clothing firms are almost eight (1/0.128) times more likely to learn from knowledge spillovers during production and distribution networks than food-processing firms, when compared to arm's length relations;

¹⁷⁶ Their exclusion by likelihood ratio statistics of the interaction variables (Table 7.A.6) is confirmed with backward elimination stepwise method (Table 7.5). Nonetheless, in contrast to the likelihood ratio statistics of interaction variable, INDUSTRY*PERIOD and INDUSTRY*FORMALITY have stayed in the analysis after the backward elimination stepwise method.

¹⁷⁷ The more detailed results tables with the odds ratios and the 95% confidence intervals around them can be found in the Appendix (Table 7.A.8).

¹⁷⁸ The estimation results for the interaction model of learning showed that significant interaction variables often have negative coefficient with odds ratio lower than 1, which makes the learning outcome in question in comparison to no learning *less* likely to occur in food-processing firms than in clothing firms (with regard to the independent variable in question). In other words, other things being equal, with regard to a specific network characteristic, clothing firms are *more* likely to learn through particular mechanisms in networks than food-processing firms.

moreover, the odds of learning from knowledge spillovers in occasional/regular relationships are around seven and a half ($1/0.132$) times greater for clothing firms than for food-processing firms, when compared to one-off relationships.

Learning from advances in S&T versus no learning: Table 7.5 (third column) presents the estimation results for the odds-ratio of learning from advances in S&T and education versus no learning for I/LM. The interaction of INDUSTRY type by FORMALITY level of the relationship is positively significant at 10% level while the interaction of INDUSTRY type by MOBILITY of people in the relationship is negative and significant (also at 10% level). These results suggest that, on the one hand, informal relationships are almost thirteen times more likely to lead to learning from advances in S&T than formal relationships, other things being equal, in Polish food-processing firms as compared to Polish clothing firms. On the other hand, Polish food-processing firms are estimated to be almost one-seventh (0.14 times) as likely to learn from advances in S&T and education through mobility of people in a relationship as Polish clothing firms; in other words, the odds of learning from advances in S&T and education through mobility of people in a relationship are seven ($1/0.14$) times greater for clothing firms than for food-processing firms.

Learning by interacting versus no learning: Table 7.5 (fourth column) presents the estimation results for the odds-ratio of learning by interacting versus no learning for I/LM. The coefficients of the INDUSTRY interaction variables for the outcome of learning by interacting are negative and marginally significant (i.e. at 10% level), differentiating industries studied with respect to time PERIOD and NETYPE. The results suggest that, other things being equal, compared to early 1990s, a Polish food-processing firm is estimated to have been 0.15 times as likely to learn by interacting in the mid-1990s as a Polish clothing firm; in other words, clothing firms were almost seven ($1/0.15$) times more likely to learn by interacting during a relationship in the mid-1990s than food-processing firms. In addition, clothing firms were approximately 14 times more likely to learn by interacting in knowledge networks than food-processing firms.

7.5.2.3 Discussion and inferences of industry differences

When industry differences are controlled for, the results of the interaction model of learning bring the technological nature of the two industries to the forefront. Clearly, the network characteristics that affect learning mechanisms used during the relationships have identified the technological levels of the two industries.

Learning from knowledge spillovers: Occasional / regular relations are less likely to be a source of spillovers for Polish food-processing firms than for Polish clothing firms, when compared to one-off relations, because food-processing firms appear to be more enthusiastic and active than clothing firms in search for new advances in S&T through informal relations and for knowledge through spillovers in technology transfers, which are most often one-off arm's length relations. Occasional/regular relations of Polish food-processing firms mostly consist of relations with public organisations that conduct the annual tests and product verifications. These relations have become so stable, and the activities so repetitive over the years that they do not generate opportunities for spillovers and learning. Moreover, this result shows that Polish food-processing firms are more focused on knowledge acquisition from one-off relations (as opposed to occasional / regular relations) than Polish clothing firms. Table 7.1 also shows the continuing importance of arm's length relations for Polish food-processing firms in the early and mid-1990s.

This I suspect to be related to the greater technology-intensity of Polish food-processing firms compared to Polish clothing firms, which also explains the one-off characteristics of contractual relations that focus on different technology transfer channels, the research projects on specific subjects with universities and/or research institutes and the informal relations within these relationships and others, such as inter-personal social networks continued between the graduates and their universities.

Table 7.5 Interaction Model of Learning: Interaction of INDUSTRY and selected NETWORK CHARACTERISTICS variables

Control variables		Interaction Model of Learning					
Variable	Learning from knowledge spillovers		Learning from advances in S&T and education		Learning by interacting		
Constant	-1.95**	(0.96)	-4.60***	(1.30)	-2.05**	(0.92)	
<u>Control variables</u>							
food-processing vs clothing industry	1.98*	(1.20)	0.77	(1.30)	0.74	(1.23)	
<u>Time period</u>							
late 1990s (1998-2001) vs early 1990s (1989-1993)	-1.97	(0.59)	0.35	(0.78)	0.09	(0.53)	
mid-1990s (1994-1997) vs early 1990s (1989-1993)	0.77	(0.69)	0.39	(0.89)	1.00	(0.63)	
<u>Characteristics of the relationship</u>							
knowledge networks vs arm's length relations	0.69	(1.00)	2.49**	(1.01)	0.61	(1.09)	
production and distribution networks vs arm's length relations	0.73	(0.68)	-2.20*	(1.32)	1.69**	(0.67)	
the firm vs the partner initiates the relationship	-0.66*	(0.40)	1.18**	(0.55)	-0.11	(0.40)	
continuous relations vs one-off	1.47**	(0.58)	0.43	(1.01)	0.56	(0.49)	
occasional relations vs one-off	1.40*	(0.73)	-0.14	(0.76)	0.35	(0.72)	
informal vs formal relations	1.42**	(0.57)	-1.44	(0.96)	-0.07	(0.58)	
<u>Characteristics of the partner</u>							
foreign partner vs Polish partner	0.99**	(0.45)	0.09	(0.54)	1.12*	(0.76)	
<u>Characteristics of the knowledge transfer during the relationship</u>							
uni-directional vs bi-directional know ledge transfer	-3.47	(0.43)	1.41**	(0.65)	0.57	(0.44)	
technology-related vs market-related know ledge	-1.08	(0.71)	1.70**	(0.82)	-2.21***	(0.79)	
production-related vs market-related know ledge	-0.28	(0.68)	0.93	(0.86)	-0.05	(0.70)	
business and quality management- related vs market-related know ledge	0.27	(0.69)	1.65*	(0.88)	-0.44	(0.71)	
there is mobility of people vs no mobility of people in the relationship	1.80***	(0.60)	1.89**	(0.74)	1.27**	(0.59)	
<u>Interaction of industry and time period</u>							
Food-processing * Late 90s	0.92	(1.08)	2.06	(1.33)	0.02	(1.03)	
Food-processing * Mid-90s	-0.45	(1.16)	0.06	(1.44)	-1.93*	(1.13)	
<u>Interaction of industry and network characteristics variables</u>							
Food-processing * Knowledge networks	-0.64	(1.25)	-1.58	(1.25)	-2.67*	(1.58)	
Food-processing * Production and distribution networks	-2.05*	(1.14)	0.19	(1.82)	0.24	(1.04)	
Food-processing * Continuous relations	-1.14	(0.97)	-1.69	(1.27)	0.62	(1.15)	
Food-processing * Occasional relations	-2.03*	(1.15)	-0.18	(1.11)	-0.63	(1.42)	
Food-processing * Informal relations	0.18	(1.07)	2.55*	(1.32)	1.37	(1.33)	
Food-processing * Mobility of people in the relation	-0.24	(0.90)	-1.99*	(1.02)	-0.18	(1.06)	
No of observations	467						
Log Likelihood	-313.21						
LR Chi-Square	510.68						
Degrees of freedom	69						
Prob > Chi-Square	0.000						
Pseudo R2 (McFadden)	0.404						
Correct classification	68.5%						
Variable Selection Method	Stepw ise (backw ard elimination)						
Variable removed	INDUSTRY*INITATOR, INDUSTRY*CONTENT, INDUSTRY*GEORIGIN						
Reference outcome	No learning during the relationship						
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.							

Source: Own dataset, SPSS version 17.0

As opposed to the West, where there are more scientific and technological opportunities acquired or spilled from industries that are horizontally linked to food-processing than from those linked to clothing industry (section 1.2.2), these results do not provide evidence of such cooperative advantages in Polish food-processing industry, helping it to shift the technological level from low-tech to medium low-tech by having positive effect on innovations in the industry (a matter examined in Chapter 8). Although the lack of such effects is consistent with the 'network failure' in the sphere of national knowledge and innovation systems (section 5.3.1), there is also no indication that Polish food-processing industry is fully supplier-dominated (given the importance of relations with universities in contractual research projects and presence of informal relations).

Reading this finding from the clothing industry viewpoint indicates that Polish clothing firms are more likely to learn from knowledge spillovers in occasional/regular relations than Polish food-processing firms, as compared to one-off relations, other things being equal. Polish clothing firms' AL relations and relations within knowledge networks are occasional / regular relations and most of them revolve around fashion and fabric fairs, relationships with consulting firms, external designers and so on, where significant amount of knowledge of end-markets resides. This finding provides some support for the importance of relatively long-term relations for more learning and spillover effects (Hägg and Johanson 1983, Håkansson and Johanson 1988, Thorelli 1986, Galaskiewicz 1985, Gulati 1995, Inkpen 1998, Kim and Inkpen 2005).

Compared to Polish clothing firms, food-processing firms are also less likely to learn from knowledge spillovers in production and distribution networks, but more likely to learn through market-based arm's length relations. This result is consistent with the above result, and explains why these firms prefer one-off relations. In fact, with regard to Polish clothing firms, this finding provides strong evidence for knowledge spillover effects as one of the indirect forms of knowledge diffusion within subcontracting relations with foreign firms in GPNs / GVCs, as mentioned in section 2.5 (Ernst 1997, Schmitz 2004). Nevertheless, during interviews, Polish clothing firms did not initially appear to have knowledge-seeking and learning motives in GPNs / GVCs with foreign partners. However, it quickly became clear that Polish clothing firms were also focusing on learning the business management methods in the industry as well as the technical side (e.g., product design) of the industry. The analysis results of the upgrading types in

Chapter 8 reflect the influence of such learning on the upgrading of Polish clothing firms.

Learning from new advances in S&T and education: With regard to the effect of industry difference on the log odds-ratio of learning from advances in S&T and education to no learning during the relationship, Polish food-processing firms are more likely to learn from advances in S&T in informal relations than Polish clothing firms, while clothing firms are more likely to learn from advances in S&T through mobility of people during the relationship than food-processing firms.

As the results of LM showed, knowledge networks, other things being equal, are more likely to lead to learning from advances in S&T than arm's length relations (LM and section 6.2.1). Therefore, for instance, personal acquaintances and relationships developed with individuals who obtain specialised knowledge e.g. at the research labs or universities are expected to lead to more learning from advances in S&T by food-processing firms than by clothing firms.

However, Polish clothing firms are more likely to learn from advances in S&T when there is mobility of people in the relationship than food-processing firms (e.g., some people - such as technicians of CAD technology - come/go and show/see the details of new scientific and technological developments, firm employees regularly participate in international and national textile and clothing fairs that facilitate exchange of knowledge and information on the latest machinery, fabrics and designs with the other producers and suppliers), irrespective of whether this relationship is informal or formally arranged. Knowledge networks of Polish clothing firms with organisations such as universities, consulting firms, public institutes are determined by the firm's needs at any one point at a time. These needs arise from the lack of capabilities within the firm, particularly in organisational matters. For instance, in the mid-1990s, large Polish clothing firms were very much concerned about their market shares (since they were in competition with one another in their domestic market), and therefore worked very closely with market research agencies and consulting firms. They used and benefited mostly from foreign consulting firms located in Poland in new organisational arrangements and developing marketing strategies, but in the late 1990s, they stopped working with them (mostly due to recession).

Although there is a specialised faculty for textiles and clothing in Łódź in Poland, none of the firms interviewed mentioned that they have any kind of relationships apart from recruiting their graduates as production manager, technologist or designer. The academics interviewed in the Textile Engineering Department of Łódź Technical University are upset about the disinterest of private firms in their academic research that could be useful in their innovations. They claim to develop relations with foreign universities and therefore effectively follow and have access to new knowledge in the area as well as their own research. They complain not only about the persistent idea among Polish clothing firms about the universities' being practically useless as in the socialist system, but also about the lack of collaboration between the industry and the university, which deprives the latter of the feedback from firms about their problems. By and large, delivery of consulting services to firms in technical areas by the academics is not common. The academics claim that the firms are parsimonious or want to get information for free while the firms claim that the knowledge of academics is either inadequate (more theoretical than practical) or too out-of-date (as they update their knowledge through learning by interacting with the firms) to meet the technical needs of the firms. Hence, despite the efforts of academics in recent years, the clothing firms are not responding to their call for collaboration.¹⁷⁹

In sum, Polish clothing firms are more willing to have technology readily provided (supporting their categorisation as a supplier-dominated industry in line with the Pavitt taxonomy), while Polish food-processing firms having more in-house engineering capabilities, appear to be technically better equipped than Polish clothing firms to build up or establish competence on the basis of, the new knowledge they acquire through informal linkages.

¹⁷⁹ Although it changes very much from sector to sector (e.g. food-processing versus clothing), this approach of the firms is not significantly different in the Romanian clothing industry. For this reason, perhaps, there is knowledge outflow from the firms to the university, for instance. An anecdote from the innovation report on Romania, which stresses the role the government has to play in promoting the image of R&D and innovation, is striking in this regard. In 2000, the Romanian Association of Employers in the R&D sector tried to adopt a new strategy and decided to organize a series of press conferences. The aim was to change the image of researchers and to attract more funds from the private sector for R&D. Contrary to expectations, the media was not friendly and supportive at all, and instead preferred to accuse the researchers of being interested in the financial aspect, and to criticize them for asking a lot of money from the budget, while offering nothing in exchange (Gamureac, 2003:13-14).

Learning by interacting: When the differences in industries are examined for the outcome learning by interacting, an additional characteristic that affects the log odds-ratio of learning by interacting to no learning during the relationship is identified: Polish clothing firms are more likely to learn by interacting in knowledge networks during mid-1990s than Polish food-processing firms, when compared to arm's length relations and early 1990s.

For Polish clothing firms, the likelihood of learning by interacting increases in the mid-1990s compared to early 1990s. This finding extends our understanding about the evolution of learning opportunities for upgrading in the GPNs/GVCs with the foreign buyers and signals knowledge accumulation. As mentioned earlier, Polish clothing firms started production for EU in the mid-1980s which took the form of OPT regime after transformation. Clearly, these relations in the early 1990s provided “an initial cushion against market losses in the 1990s” (Pickles *et al.* 2006: 2310) and served as a stage of survival against a possible shake-out in the clothing industry. Building on this positive experience of the early 1990s, Polish clothing firms appear to be more likely to learn by interacting not only with foreign buyers in GVCs/ GPNs but also with other value chain actors since the mid-1990s, when compared to Polish food-processing firms, other things being equal. They are approximately fourteen times more likely to learn by interacting in knowledge networks than Polish food-processing firms, indicating clothing firms are more likely to learn during their relationships with suppliers, customers, users and complementary firms in the Polish clothing industry when these relationships aim at or lead to product and process improvement and/or development, quality improvement, scientific advice, joint experimentation, and so on instead of simple value chain activities.

What Polish clothing firms were missing in their perception of knowledge networks throughout these years was the opportunity these networks would provide in developing capabilities or functions that require creativity (for genuine innovation) and allow a firm to become a leader, such as in design. Instead, they favoured GPNs/GVCs, in other words their foreign partners, for bringing in knowledge on design and indirectly helping them to develop imitative design capabilities as a start. Whether these imitative design capabilities have been upgraded to innovative design capabilities is a matter of

perspective. In the late 1990s, Polish clothing firms started working with well-known designers who were mostly external to the firm and not employed in-house.

7.5.2.4 Summary

In summary, interaction model of learning identifies the differences between the industries. It becomes clear that they differ with regard to the nature of the technological level of the industries. The medium-tech nature of the Polish food-processing firms as compared to the low-tech nature of the Polish clothing firms is observable in their higher likelihood of learning opportunities during their relationships through spillovers and new advances in S&T. Compared to Polish clothing firms, the Polish food-processing firms are more likely to learn from knowledge spillovers, albeit mostly in one-off, arm's-length relations, which indicates their interest in technology transfer projects not simply as users of the externally acquired technology. It seems like Polish food-processing firms use arm's-length relations for external knowledge acquisition, i.e. pure market relationships. However, in fact, as discussed in section 2.3.2 (in line with Kim 1980, 1997), in emerging markets in the transition years, foreign technology suppliers serve as an important source of knowledge not that is otherwise available to domestic firms. On the other hand, other things being equal, Polish clothing firms are more likely to experience positive spillover effects in relatively long-term relations.

When firms working together with the engineers and technicians of the technology supplier during installation and receive training in the handling of the machinery and equipment, technological knowledge is transferred from a first-hand source and through face-to-face interaction. This kind of relationship between the engineers of foreign technology supplier and domestic firm proves to be significant for the latter in developing in-house problem-solving capabilities, which over time turn into capability to make minor and even major changes in production processes and develop new products as a result of learning by using, doing and training (as will be discussed in the next chapter).

Again compared to Polish clothing firms, they are more likely to learn from new advances in S&T through informal relations, which indicates not only the continuing old networks (mostly in the form of habits of engineers in the firms to keep their contact

with their university professors) but also the interest in the firms in searching for and following the latest advances in S&T through the cheapest ways and closest links. Polish food-processing firms were engaged in informal relations before 1989 and with the transition they kept up these relationships to the extent they could. However, this kind of unbroken linkage within the domestic industry has unfortunately brought no advantage to the food-processing firms. These relationships were based on either simple production relations that had been abolished (e.g. with collective farms) or obsolete knowledge bases which did not meet the required process upgrading in these firms. At the same time, at the beginning of the transition years, their efforts to establish relationships with foreign partners were unsuccessful due to imbalance between their knowledge bases. Therefore, these relationships cannot be interpreted as a sign of linkage capabilities but are rather a continuation of habitual historical linkages for a while after the transition.

Corroborating the low-tech nature of the Polish clothing firms, the results for industry differences show that the Polish clothing firms use mobility of people (e.g., global buyers, their technicians and the technicians of the technology suppliers) to have access to information about the new advances in S&T (and spillovers through production networks), instead of putting effort to search for it. As a consequence, the knowledge systems the Polish clothing firms most often rely on / emerge out of the interactions with the value chain actors that focus on markets and production, rather than technology. So, learning by interacting becomes a significant learning mechanism for the Polish clothing firms that help improve their knowledge stock, organisational routines and systems.

7.6 CONCLUSION

This chapter explored the relationship between network characteristics and learning mechanisms that used in knowledge and production & distribution networks when compared to arm's length relations. Predictive models of mechanisms for external learning to the firm for the sample of relationships established by Polish food-processing and clothing firms, namely the Learning Model and its interaction model are used for this exploration. The LM was built upon the notion that network characteristics were composed of the characteristics of the relationship per se, the characteristics of the partner involved in the relationship and the characteristics of the knowledge transfer

during the relationship. A representative list of factors for each characteristic was carefully chosen on the basis of the literature survey (Chapter 4).

As a result, the analysis in this chapter distinguished the elements that characterise the three learning mechanisms external to the firm on the basis of these chosen network characteristics. Moreover, the results of the analysis in this chapter indicate that the characteristics of networks that affect learning mechanisms external to the firm differ among industries. However, time period appeared to be statistically not significant in both models, suggesting that Polish LMT firms used the three learning mechanisms during their relationships over the transition years without distinguishing one over the other. Moreover, this model was built to determine the network characteristics that affect learning mechanisms, so the construction of the variables did not target to understand the rate or evolution of learning over time. It makes more sense to investigate the evolution of upgrading (pattern), which is observable through association between time periods and types of firm-level upgrading. Then it can be inferred that the knowledge acquired from relationships is internalised and accumulates within the firm over time. That part of the analysis is discussed in detail in the next chapter.

Chapter 8 LEARNING IN NETWORKS AND FIRM-LEVEL UPGRADING

8.1 INTRODUCTION

Previous chapter examined the role of networks in firm-level upgrading by having a closer look into the much discussed but empirically not analysed topic of mechanisms for learning external to the firm. It determined the network characteristics that distinguish these mechanisms best. This chapter will complement the analysis by looking at the contribution of these learning mechanisms and network related sources to firm-level upgrading types.

This chapter also presents the results of the empirical research conducted on the sample of 467 relationships of Polish food-processing and clothing firms. A predictive model of types of firm-level upgrading was specified and estimated for this dataset, namely the Upgrading Model (UM). A multinomial logistic regression model of upgrading types was used in order to distinguish which learning mechanisms in networks better explain different types of firm-level upgrading.

After a brief overview of the research questions examined in this chapter (section 2), section 3 will present the UMs adopted in this empirical chapter with their specific predictors. The descriptive statistics of the variables are described in section 4, followed by a presentation of the estimation results of MLR analysis and discussion of these results (section 5). Section 6 concludes.

8.2 RESEARCH QUESTIONS

The research question this chapter aims to answer is “How does learning in networks contribute to firm-level upgrading in food-processing and clothing industries in Poland?” In other words, this chapter examines whether and how learning in networks contributes to various ‘types of firm-level upgrading’ as a result of the effects of network characteristics on external learning mechanisms analysed in the previous chapter. Hence, in accordance with the definition of learning in networks in two stages (section 3.2.3), it will first examine the sole effect of learning mechanisms external to the firm and then the combined effect of these mechanisms and of the complementary internal factors that represent internalisation of externally acquired knowledge, on firm-

level upgrading. Of particular interest in this chapter is in finding out the extent of the *mediating* effect of internal factors complementary to the external learning mechanisms on the firm-level upgrading types, since without these factors learning in networks would have little chance to turn into upgrading within the firm. Last but not least, it will also look at the impact of firm strategies developed as a result of learning in networks on firm-level upgrading and examine the industry differences with a separate interaction model of upgrading.

The dependent variable is ‘types of firm-level upgrading’, as drawn from the upgrading literature (Table 4.11 in section 4.5.2.1). The major independent variable of the models used in this chapter is the dependent variable of the previous analysis in Chapter 7 ‘learning mechanisms external to the firm’ (Table 4.8 in section 4.5.1.1).

Based on the description of the main features of the model, the sub-questions that this chapter addresses using the multinomial logistic model are:

1. How do various external learning mechanisms contribute to firm-level upgrading?
2. How do internal factors complementary to these learning mechanisms mediate in contributing to firm-level upgrading?
3. How do firm strategies as a result of learning in networks contribute to firm-level upgrading?
4. To what extent do the contribution of external learning mechanisms and their complementary internal factors to the types of firm-level upgrading differ between food-processing and clothing industries, and how much of observed differences in firm-level upgrading types is a result of firm strategies?

8.3 ESTIMATING THE UPGRADING MODELS

This section first describes the four sets of upgrading models (UMs), which were presented and discussed earlier in section 4.6.4.6 of methodology chapter, with which empirical assessment of the factors that contribute to types of firm-level upgrading in Polish food-processing and clothing firms will be done. These UMs were again estimated using MLR on the dataset created by the relationships of large Polish LMT firms. The dependent variable for estimating these models was ‘types of firm-level upgrading’ (Y_i), where:

$Y_i = 1$ if there is managerial upgrading,
 $Y_i = 2$ if there is process upgrading,
 $Y_i = 3$ if there is product upgrading,
 $Y_i = 4$ if there is functional upgrading,
 $Y_i = 5$ if there is no upgrading.

The independent variables of the models used in this chapter were ‘learning mechanisms external to the firm’ (EXTLEARN); internal factors complementary to learning mechanisms external to the firm, which were composed of learning mechanisms internal to the firm (INTLEARN) and knowledge sharing levels within the firm (KNOWSHARE), and firm strategies (STRATEGY). In addition to these independent variables, the other regressors used in these models were constant and a control variable (INDUSTRY) and time variable (PERIOD). All of them were expected to have effect on types of firm-level upgrading (see Table 4.13 in section 4.5.2.4).

Four MLR models were specified to assess factors contributing to the types of firm-level upgrading: UM.1 looks solely at the *main effects* of the contribution of external learning mechanisms on types of firm-level upgrading and answers the first sub-question above. UM.2 shows how complementary internal factors *mediate* between external learning mechanisms and types of firm-level upgrading and answers the second sub-question. UM.3 investigates the additional impact of firm strategies on types of firm-level upgrading and answers the third sub-question. The interaction model (I/UM) aims to answer the fourth sub-question above: how much of the observed differences in types of firm-level upgrading is the result of industry differences and firm strategies.

Estimations were carried out using the full sample. The sample characteristics and the descriptive statistics are discussed in section 8.4. The UMs to be estimated by MLR analysis are reproduced below with the relevant independent variables:

Upgrading Model 1 (*with learning mechanisms external to the firm only*)

$$\begin{aligned}
 \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE}=5)) &= \log (p_{ij} / p_{i5}) \\
 &= \alpha_{j0} + \beta_{j1}\text{EXTLEARN} + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD}
 \end{aligned}
 \tag{UM.1}$$

According to the UM.1, the log odds-ratio is α_{j0} for a relationship that leads to no learning externally. β_{jk} measure the degree of external learning characteristics with respect to the types of firm-level upgrading. θ_{jk} serve for the industry variable to assess

industry-related effects and for time period to assess the temporal effects. These variables will be used in all the UMs below.

Upgrading Model 2 with mediating factors (i.e. added variables of internal factors complementary to learning mechanisms external to the firm)

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE}=5)) &= \log (p_{ij} / p_{i5}) \\ &= \alpha_{j0} + \beta_{j1}\text{EXTLEARN} + \beta_{j2}\text{INTLEARN} + \beta_{j3}\text{SHARING} \\ &\quad + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} \quad (\text{UM.2}) \end{aligned}$$

According to the UM.2, the log odds-ratio is α_{j0} for a relationship that leads to no learning both externally and internally though there is knowledge sharing at all the levels of the firm. β_{jk} measure the degree of learning mechanisms in networks external and internal to the firm with respect to the types of firm-level upgrading.

Upgrading Model 3 with the additional effect of firm strategy

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE}=5)) &= \log (p_{ij} / p_{i5}) \\ &= \alpha_{j0} + \beta_{j1}\text{EXTLEARN} + \beta_{j2}\text{INTLEARN} + \beta_{j3}\text{SHARING} + \beta_{j4}\text{STRATEGY} \\ &\quad + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} \quad (\text{UM.3}) \end{aligned}$$

According to the UM.3, the log odds-ratio is α_{j0} for a relationship that leads to no learning both externally and internally, with knowledge that is acquired externally shared at all levels of the firm and the firm pursuing competition-oriented upgrading strategy. β_{jk} measure the degree of learning mechanisms in networks and firm strategy with respect to the types of firm-level upgrading.

Interaction Model of Upgrading for industry differences

$$\begin{aligned} \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE}=5)) &= \log (p_{ij} / p_{i5}) \\ &= \alpha_{j0} + \beta_{j1}\text{EXTLEARN} \\ &\quad + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} \\ &\quad + \gamma_{j1}\text{INDUSTRY*PERIOD} + \gamma_{j2}\text{INDUSTRY*EXTLEARN} \quad (\text{I/UM.1}) \end{aligned}$$

$$\begin{aligned}
& \log (\text{Prob}(\text{UPGTYPE}=j) / \text{Prob} (\text{UPGTYPE}=5)) = \log (p_{ij} / p_{i5}) \\
& = \alpha_{j0} + \beta_{j1}\text{EXTLEARN} \\
& \quad + \beta_{j2}\text{INTLEARN} + \beta_{j3}\text{SHARING} + \beta_{j4}\text{STRATEGY} \\
& \quad + \theta_{j1}\text{INDUSTRY} + \theta_{j2}\text{PERIOD} \\
& \quad + \gamma_{j1}\text{INDUSTRY*PERIOD} + \gamma_{j2} \text{INDUSTRY*EXTLEARN} \\
& \quad + \gamma_{j3}\text{INDUSTRY*INTLEARN} + \gamma_{j4}\text{INDUSTRY*SHARING} \\
& \quad + \gamma_{j5}\text{INDUSTRY*STRATEGY} \quad \quad \quad \textbf{(I/UM.3)}
\end{aligned}$$

In the interaction models of upgrading, all the coefficients are the same as in UM.1 and UM.3 respectively, except the interaction terms: γ_{jk} allow the degree of external learning mechanisms, the complementary internal factors and firm strategy to vary with industry differences (I/UM).

In this analysis, using $Y=5$ (i.e. no upgrading) as the ‘reference outcome’, the log-odds ratios of these probabilities in each model will yield four logit functions:

logit 1: $(\log (p_{11} / p_{15})) = \log [\text{Pr} (\text{managerial upgrading})/\text{Pr} (\text{no upgrading})]$

logit 2: $(\log (p_{12} / p_{15})) = \log [\text{Pr} (\text{process upgrading})/\text{Pr} (\text{no upgrading})]$

logit 3: $(\log (p_{13} / p_{15})) = \log [\text{Pr} (\text{product upgrading})/\text{Pr} (\text{no upgrading})]$

logit4: $(\log (p_{14} / p_{15})) = \log [\text{Pr} (\text{functional upgrading})/\text{Pr} (\text{no upgrading})]$

These logit functions mean probability of managerial upgrading, of process upgrading, of product upgrading and of functional upgrading compared to the probability of the reference outcome ‘no upgrading’; all with separate parameter estimates. Similar technicalities of MLR analysis in Chapter 7 apply in this chapter. The results are presented in Tables 8.3 to 8.7. There are four sets of results for each logit function comprising all models concerned. Before discussing the results, descriptive statistics of the variables were briefly explained.

8.4 DESCRIPTIVE STATISTICS

This section explores the descriptive statistics of the variables used in the abovementioned UMs. As discussed in Chapter 7, because the variables used are categorical, descriptive statistics are largely limited to crosstabulations and chi-square tests of independence. Following Tabachnick and Fidell (2007) and Petrucci (2009), the possibility of high multicollinearity between independent variables is controlled through checking for standard errors of the variables that are greater than 2 after the models are run.

First the distribution of relationships in the dataset by the dependent and independent variables of the UMs is explored. Second the association between dependent variable and the independent variables of the UMs that verifies the model building is discussed.

8.4.1 Variables of Upgrading Models

Table 8.1 presents the frequencies of relationships related to the variables that contribute to the types of firm-level upgrading and compares the frequencies of relationships across the Polish food-processing and clothing industries. The distribution of time PERIOD and EXTLEARN were examined in section 7.4.1 of Chapter 7.

Table 8.1 shows that there is fairly equal distribution of learning mechanisms internal to the firm in the dataset. Polish food-processing firms internalise the externally acquired knowledge mostly by means of ‘learning by using + monitoring’ (32.8%) and ‘learning by training + research’ (31.8%). Clothing firms, on the other hand, focus on ‘learning by doing + imitating + failing’ (32.7%), which is supplemented by ‘learning by training + research’ and ‘learning by using + monitoring’ (25.4% and 23.5% respectively). Internal learning does not take place approximately in one-fifth (20%) of total relations and of the relations of both industries.

Levels of knowledge sharing within the firm significantly differ between the two industries; with emphasis on more “specialised” intra-unit knowledge sharing in the food-processing firms and on more “teamwork-oriented” inter-personal/ inter-unit knowledge sharing in the clothing firms. As a result of over 55% of the relationships they are involved in, firms pursue competition-oriented upgrading strategies. Competence-orientation in firm strategies for upgrading purposes is not any less significant, though. This pattern seems to be the same for both industries.

Finally, the distribution of the dependent variable ‘types of firm-level upgrading’ shows that contribution of the relationships is focused more on process and functional upgrading in both industries, with the contribution to product upgrading in the clothing firms twice as great as in the food-processing firms (17% vs. 8%) and contribution to managerial upgrading significantly greater in food-processing firms than in clothing firms (23% vs. 10%). 16-19% of the relationships in the food-processing and clothing

firms respectively make no contribution to firm-level upgrading. The distribution of dependent variable by independent variables can be found in Table F.12 in Appendix F, as part of the descriptive statistics of all the variables used in the MLR analysis in this chapter. A detailed distribution of dependent variable by network types and external learning mechanisms in all firms as well as by industry type can also be found in Tables F.1 and F.2 in Appendix F.

Table 8.1 Distribution of relationships by dependent and independent variables and by industry type and the non-parametric test results of these variables

	Total relationships			Industry type (INDUSTRY)						Pearson Chi-Square Test (Asymp. Sign. 2-sided): INDUSTRY TYPE vs (VARIABLE)
				Relationships of Food-processing firms			Relationships of Clothing firms			
	count	%	Chi-square test (Asymp. Sig.)	count	%	Chi-square test (Asymp. Sig.)	count	%	Chi-square test (Asymp. Sig.)	
Sample size	467	100.0		195	41.8		272	58.2		
Time period (PERIOD)			0.000***			0.000***			0.000***	0.025**
late 1990s	262	56.1		117	60.0		145	53.3		
mid-1990s	132	28.3		58	29.7		74	27.2		
early 1990s	73	15.6		20	10.3		53	19.5		
Learning external to the firm (EXTLEARN)			0.000***			0.000***			0.000***	0.000***
learning from knowledge spillovers	125	26.8		55	28.2		70	25.7		
learning from advances in S&T	109	23.3		67	34.4		42	15.4		
learning by interacting	157	33.6		46	23.6		111	40.8		
no learning / no awareness of learning	76	16.3		27	13.8		49	18.0		
Learning internal to the firm (INTLEARN)			0.044**			0.000***			0.009***	0.000***
learning by doing +learning by imitating + learning by failing	116	24.8		27	13.8		89	32.7		
learning by using + learning by monitoring	128	27.4		64	32.8		64	23.5		
learning by training +learning by research	131	28.1		62	31.8		69	25.4		
no learning / no awareness of learning	92	19.7		42	21.5		50	18.4		
Level of knowledge sharing level within the firm (KNOWSHARE)			0.000***			0.000***			0.000***	0.000***
within unit	179	38.3		94	48.2		85	31.3		
inter-personal/inter-unit	207	44.3		48	24.6		159	58.5		
divisional/within the firm	81	17.3		53	27.2		28	10.3		
Firm strategy (STRATEGY)			0.000***			0.073*			0.001***	0.447
competence-oriented	194	41.5		85	43.6		109	40.1		
competition-oriented	273	58.5		110	56.4		163	59.9		
Dependent variable										
Types of Firm Upgrading (UPGTYPE)			0.000***			0.000***			0.000***	0.000***
managerial upgrading	72	15.4		45	23.1		27	9.9		
process upgrading	128	27.4		60	30.8		68	25.0		
product upgrading	62	13.3		16	8.2		46	16.9		
functional upgrading	122	26.1		43	22.1		79	29.0		
no upgrading	83	17.8		31	15.9		52	19.1		

Source: Own dataset, SPSS version 17.0

The non-parametric chi-square test result of the dependent variable as well as its Pearson chi-square test result shows that UPGTYPE is statistically significant at 1% level and is associated with the industry type, indicating that the two industries significantly differ in terms of types of firm-level upgrading. This finding means looking at the industry interactions with factors contributing to firm-level upgrading will enrich our understanding of the sources of differences within LMT industries (i.e. interaction model of UM.3).

Asymptotic significance of the chi-square tests of each variable for all firms, food-processing firms and clothing firms are also presented in Table 8.1 (columns 4, 7 and 10). Each independent variable used in the UMs is statistically significant at 1% level, except the variable INTLEARN (which is statistically significant at 5% level for all firms) and STRATEGY (which is statistically significant at 10% level for food-processing firms). Moreover, Table 8.1 displays the Pearson chi-square test results for the cross-tabulations between the industry type and each independent variable. There is strong association between INDUSTRY type and all the variables at 1% level, except confirmative association between INDUSTRY type and time PERIOD at 5% level, and there is no association between INDUSTRY type and STRATEGY variable, indicating that there are no differences in the distribution of competence- and competition-oriented firm strategies among food-processing and clothing industries.

8.4.2 Associations between dependent and independent variables

As explained in section 4.6.4.3, the same model building procedure in MLR as in Chapter 7 was followed in this chapter. Examining the cross-tabulations (Table F.12 in Appendix F), a potential problem with expected zero frequencies in cells formed by combinations of independent variables with the five-category dependent variable seemed likely.¹⁸⁰ This can cause unexpected singularities in the Hessian matrix and necessitate either excluding some of the variables or merging their categories, or even eliminating the variable, particularly in the interaction model. The variables were examined to see what could be done in order to eliminate this potential problem: As the dependent variable of LM in Chapter 7 act as the primary independent variable in the UMs (i.e. EXTLEARN), the statistical inferences of the UMs with regard to EXTLEARN in this chapter rely strictly on the results of the LM. Therefore, the interpretation of the relationship between external learning mechanisms and network characteristics presented in Chapter 7 serves as a reference point here, giving reliability and consistency on the interpretation of the UM results in this chapter.

The variable INTLEARN was derived from the learning literature, and therefore its categories were strictly discrete in nature, with specific definitions. They were already

¹⁸⁰Particularly due to the presence of cells with counts less than 5 as well as zero cells in variables with more than 2 categories.

grouped under general categories of sources of knowledge. Therefore, it is not preferable to collapse its categories further.

The variable PERIOD could be collapsed into two categories as ‘late 1990s and early 2000s’ and ‘early to mid-1990s’, in which case the potential problem of zero cells would be eliminated. So, regressions were run by combining the early 1990s with mid-1990s and comparing it with late 1990s. However, no significant change in the results was found (Table F.13 in Appendix F) and comparison of log-likelihood ratios for both models showed statistically significant improvement with more categories of time PERIOD, $\chi^2(4, 467) = 16.36, p < 0.005$ (a significant probability value). Therefore, time period with three categories have been kept throughout the rest of the analysis in UMs in order not to lose our ability to distinguish the effect of specific time periods in transition years on types of firm-level upgrading.

Table 8.2 Pearson Chi-Square test results for cross-tabulations between the dependent and each independent variable used in Upgrading Models

Test Statistics: Pearson Chi-Square			
UPGTYPE versus independent variables	Value	df	Two-sided Asymp. Sig. (<i>p</i>)
INDUSTRY	23.392	4	0.000
PERIOD	20.715	8	0.008
EXTLEARN	138.618	12	0.000
INTLEARN	125.648	12	0.000
KNOWSHARE	187.905	8	0.000
STRATEGY	47.932	4	0.000

Source: Own dataset, SPSS version 17.0

The Pearson chi-square test results of the dependent variable versus each independent variable used in UMs show that there is association between the dependent variable and all the independent variables in these models, and that they are statistically significant at 1% level (Table 8.2). As mentioned earlier in Chapter 7, variables with *p*-value lower than 0.25 are candidates for the multivariable model (Hosmer and Lemeshow 2000), and all the independent variables used in the UMs meet this criterion.

8.5 ESTIMATION RESULTS

This section will discuss the estimation results of the MLR analyses for each UM. Tables 8.3 - 8.7 below present the MLR results of all the models for all four logit

functions of types of firm-level upgrading of managerial, process, product and functional upgrading versus no upgrading.

8.5.1 Upgrading Model 1: The contribution of learning mechanisms external to the firm to types of firm-level upgrading

The Upgrading Model 1 (UM.1) was estimated through MLR to assess the prediction of firm-level upgrading types in one of abovementioned five outcomes on the basis of learning mechanisms external to the firm (EXTLEARN) as the sole independent variable. The major questions UM.1 answers were to which upgrading types external learning mechanisms contribute and to what extent. Once the nature and the strength of the associations between external learning mechanisms and types of firm-level upgrading are determined through UM.1, the results of the analyses made in the previous chapter (Chapter 7) will be used to elaborate *how* these external learning mechanisms contribute to the types of firm-level upgrading.

UM.1 with zero restrictions is compared with the full specifications model without any restrictions imposed on its coefficients, and the result showed that imposing the zero restrictions did not change any of the coefficient estimates or model fit in UM.1; they were actually the same. Hence, the UM.1 estimated with the backward elimination stepwise method is displayed and used in the analysis below.

8.5.1.1 Overall Model Fit

Before examining the estimates, the overall fit of UM.1 was assessed. As Table 8.3 displays, the χ^2 value of UM.1 decisively reject the null hypothesis ($p < 0.001$), meaning that UM.1 has greater explanatory power than a ‘constant only’ model. The overall correct classification is 44%. Pseudo R^2 (McFadden) for the UM.1 was 0.128, suggesting the variables in this model explain almost 13% of the variability in types of firm-level upgrading. The likelihood ratio tests of each estimated independent variable show that each of the variables has some association ($p < 0.25$) with the outcome of firm-level upgrading types (Table F.14 in Appendix F).

In the following sub-section, the estimates from the four logit functions of UM.1 were made using Table 8.3, which shows the regression coefficients, the statistical

significance of Wald χ^2 tests and standard errors in parenthesis.¹⁸¹ Each logit function compares the probability of a particular upgrading type with no upgrading.

8.5.1.2 The Estimates

Table 8.3 presents the results of UM.1. Contrary to the LMs in Chapter 7 above, time appears to be a significant factor in UMs; different time periods during transition years have significant effects on the likelihood of different types of firm-level upgrading. Ability to observe the significance of time periods in UMs allows us to capture the effects of change over time on the likelihood of different types of firm-level upgrading, hence a dynamic analysis of firm-level upgrading. Indirectly, the effect of learning mechanisms in networks over time is also observed.

Managerial upgrading versus no upgrading

The estimation results of Table 8.3 (second column) show that both the control variable (INDUSTRY) and time variable (PERIOD) are significant for managerial upgrading in the firm, yet the effect of independent variable (EXTLEARN) is statistically significant but negative (all of them are statistically significant at 5% level). In other words, among the three characteristics that were identified based on these significant factors in UM.1, being a food-processing firm (INDUSTRY) and having relationships that started in the late 1990s (PERIOD) positively affect the log odds-ratio of managerial upgrading to no upgrading within the firm, while learning by interacting during a relationship negatively affect.

More precisely, Polish food-processing firms are twice more likely to achieve managerial upgrading than Polish clothing firms. Relationships that started in the late 1990s are seven times more likely to contribute to managerial upgrading than the ones that started in the early 1990s. This is in line with the distribution of relationships within time periods which shows that while 2.7% of the relationships that started in the early 1990s were contributing to managerial upgrading within the firm, this increased to 18.7% in the late 1990s (Table F.12 in Appendix F). Hence, this result suggests that not only does the number of relationships that contribute to managerial upgrading within the firm increase over time, but also the likelihood of their contribution to managerial

¹⁸¹ The more detailed results tables with odds ratios and the 95% confidence intervals around them can be found in Table f.13 in Appendix F.

upgrading increases. In other words, firms learn more for their managerial upgrading from their relationships that started in the late 1990s than from those started in early 1990s. However, these relations are not the ones that lead to learning by interacting, since the likelihood of a contribution to managerial upgrading by learning by interacting is one-fourth (0.25) as likely as no learning taking place during the relationship. Based on other statistical evidence from the sample of this research, this result is not surprising: Only 3.8% of relationships that lead to learning by interacting contribute to managerial upgrading (Table F.12 in Appendix F). The MCA results in Figure F.1 in Appendix F.1 also showed that managerial upgrading was not associated with learning by interacting at all. Theoretically, though, it is surprising.

Process upgrading versus no upgrading

The estimation results of Table 8.3 (third column) show that EXTLEARN and time PERIOD when the relationship started are significant factors for process upgrading within the firm. Based on these factors in UM.1, two characteristics can be identified that affect the log odds-ratio of process upgrading to no upgrading within the firm:

- Learning from advances in S&T during a relationship, and
- Having relationships that started in the early 1990s.

The coefficient of ‘learning from advances in S&T and education’ is positive and statistically significant at 1% level, suggesting that the odds of process upgrading occurring through learning from advances in S&T and education during a relationship is seventeen times greater compared to no learning than the odds of no upgrading. The relationships that started in the mid- and late 1990s have negative coefficients and are significant at 5% and 10% levels with 95 percent confidence intervals (0.22, 1.09) and (0.14, 0.78) respectively. This means that they are 0.50 and 0.33 times as likely, respectively, to contribute to process upgrading as the relationships that started in the early 1990s. In other words, the relationships that started in the early 1990s are three times more likely to contribute to process upgrading within the firm than the relationships that started in the mid-1990s and twice more likely than the relationships that started in the late 1990s. As Table 8A.1 in Appendix H shows, 40% of the relationships started in the early 1990s contributed to process upgrading as compared to 25% of the relationships that started in the mid-and late 1990s. This result suggests that, although the number of relationships increases over time (Table 6.3 in section 6.3.1),

the likelihood of their contribution to process upgrading reduces. In other words, firms learn more in the relationships that started in the early and mid-1990s compared to late 1990s for their process upgrading.

Product upgrading versus no upgrading

The estimation results of Table 8.3 (fourth column) show that EXTLEARN and INDUSTRY type are significant factors that affect the odds of product upgrading within the firm. Based on these factors in UM.1, two characteristics can be identified that affect the log odds-ratio of product upgrading within the firm to no upgrading:

- Being a clothing firm, and
- All the learning mechanisms external to the firm (i.e. learning from advances in S&T, learning from knowledge spillovers and learning by interacting).

Table 8.3 Estimation results of multinomial logistic regression for UM.1

	Upgrading Model 1							
Variables	managerial upgrading		process upgrading		product upgrading		functional upgrading	
Constant	-2.09***	(0.80)	0.06	(0.44)	-1.77**	(0.71)	-0.73	(0.47)
<u>Control variable</u>								
food-processing vs clothing industry	0.73**	(0.35)	0.00	(0.32)	-0.68*	(0.38)	-0.05	(0.31)
<u>Time period</u>								
late 1990s (1998-2001) vs early 1990s (1989-1993)	1.95**	(0.79)	-0.71*	(0.41)	-0.07	(0.47)	0.71*	(0.42)
mid-1990s (1994-1997) vs early 1990s (1989-1993)	1.27	(0.82)	-1.12**	(0.44)	-0.32	(0.51)	0.08	(0.46)
<u>Learning mechanisms external to the firm</u>								
learning from knowledge spillovers vs no learning	0.44	(0.44)	0.73	(0.47)	2.39***	(0.69)	0.79*	(0.43)
learning from advances in S&T and education vs no learning	0.86	(0.54)	2.84***	(0.52)	2.41***	(0.79)	0.00	(0.64)
learning by interacting vs no learning	-1.41**	(0.55)	0.40	(0.43)	1.84***	(0.67)	1.10***	(0.39)
No of observations	467							
Log Likelihood	-148.542							
LR Chi-Square	187.441							
Degrees of freedom	24							
Prob > Chi-Square	0.000							
Pseudo R2 (McFadden)	0.128							
Correct classification	43.9%							
Variable Selection Method used:	Stepwise (backward elimination)							
Variable removed from the MLR analysis:	None							
Reference outcome	No upgrading							
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.								

Source: Own dataset, SPSS version 17.0

The coefficients of all the learning mechanisms external to the firm are positive and statistically significant at 1% level, suggesting that the odds of product upgrading through learning from advances in S&T and education and through learning from knowledge spillovers are eleven, and the odds of product upgrading through learning by interacting six times greater compared to no learning in the relationship than the odds of no upgrading.

The coefficient of INDUSTRY type is negative and marginally significant at 10% level, suggesting that Polish food-processing firms are one-half (0.51) as likely to achieve product upgrading as Polish clothing firms. In other words, this result suggests that clothing firms are twice more likely to achieve product upgrading than food-processing firms.

Functional upgrading versus no upgrading

The estimation results of Table 8.3 (fifth column) show that both PERIOD and EXTLEARN are significant factors for functional upgrading within the firm. Based on these factors in UM.1, two characteristics can be identified that affect the log odds-ratio of functional upgrading within the firm to no upgrading:

- Learning by interacting and to some extent learning from knowledge spillovers during a relationship, and
- Having relationships that started in the late 1990s.

The coefficient of ‘learning by interacting’ is positive and statistically significant at 1% level, while the coefficient of ‘learning from knowledge spillovers’ is also positive but marginally significant at 10% level, suggesting that the odds of a relationship contributing to functional upgrading within the firm through learning by interacting and learning from knowledge spillovers during that relationship are three and two times greater, respectively, when compared to no learning in that relationship than the odds of no upgrading.

The coefficient of ‘late 1990s’ category of time PERIOD is positive but marginally significant at 10% level, suggesting that relationships that started in the late 1990s are twice as likely to contribute to functional upgrading than relationships that started in the

early 1990s. The distribution of relationships by time periods show that while 3.2% of the relationships that started in the early 1990s were contributing to functional upgrading within the firm, this increased to 16.5% in the late 1990s. This result suggests that, not only the number of relationships, but also the likelihood of their contribution to functional upgrading increases over time (Table F.12 in Appendix F).

In summary, the estimation results of UM.1 in Table 8.3 show that there is strong evidence that learning mechanisms external to the firm are important and influential factors that change the odds of types of firm-level upgrading:

- *Learning from knowledge spillovers* during a relationship contributed more to *product* and to some extent to *functional* upgrading relative to managerial and process upgrading than no learning.
- *Learning from advances in S&T* during a relationship contributed more to *process and product* upgrading than no learning.
- *Learning by interacting* during a relationship contributed more to *product and functional* upgrading relative to *managerial* upgrading than no learning.

INDUSTRY type and time PERIOD also appear to be significant factors that make a difference in the odds of specific types of firm-level upgrading. The examination of the estimated odds ratios and their confidence intervals for the INDUSTRY type shows that *managerial* upgrading is more likely to occur in *food-processing firms* when compared to no upgrading, and *product* upgrading in *clothing firms*.

The examination of the estimated odds ratios and their confidence intervals for the time PERIOD show that the association of ‘the relationships that started in the *late 1990s*’ compared to early 1990s is strongest with *managerial and functional* upgrading, relative to other upgrading types, and compared to no upgrading. Managerial and functional upgrading appear to be emerging upgrading types with a greater contribution of the relations that were started in the late 1990s than those of early 1990s, indicating that emerging market LMT firms were just beginning to learn to give strategic emphasis to organisational types of upgrading. On the other hand, *process* upgrading is more likely to happen through relationships that started in the *early 1990s*’ than those started in mid- and late 1990s, when compared to no upgrading. Over the transition years, the

contribution of learning in networks to process upgrading declined; while its contribution to managerial and functional upgrading increased. All three learning mechanisms external to the firm contribute to product upgrading irrespective of time.

These results indicate that in the late 1990s, Polish LMT firms came to understand the importance of firm-level upgrading as sources of competitiveness and they realised that the modernisation of machinery and equipment is not enough for achieving it. CEE firms' preference in the early transition years for using technology transfer to expand production capacity rather than building technological capabilities (Bell and Pavitt 1995, Bell 1997) has been replaced by preference for building organisational capabilities.

8.5.1.3 Discussion in the light of results for Learning Models of Chapter 7

Interpreting the estimation results of UM.1 in the light of the estimation results for learning mechanisms external to the firm (i.e. LM in Chapter 7) will make more sense. The results of UM.1 indirectly examine the effects of knowledge acquisition and transfer through networks, which was a necessary step for emerging market firms to be successful in upgrading (particularly in the period of transition).

a. Implications for managerial upgrading

Strikingly, the estimation results for UM.1 show that learning by interacting impedes managerial upgrading within the firm. When we remember the characteristics of networks that affect learning by interacting from Chapter 7, this means production and distribution networks *per se* impedes managerial upgrading. Since these networks represent the GVCs/GPNs as examined in the upgrading literature, this finding for the transition period is consistent with the literature that global buyers, global marketers (e.g. hypermarkets) do not want their suppliers to encroach on their core competences, and therefore they share information and knowledge carefully and up to a limit where they can control the upgrading of their suppliers (Schmitz 2006, Bazan and Navas-Aleman 2004, Tokatli and Eldener 2004, Schmitz and Knorrninga 2000). So, GVCs/GPNs do not constitute means for managerial upgrading, and there is no significant effect of other learning mechanisms on managerial upgrading. The results of LM reveal that learning by interacting leads to transfer of market-related knowledge

that is generally obtained from consulting firms, market research firms, and advertising agencies (Simonin 1999b), but this result also indicates that the effective and distinctive deployment and coordination of this knowledge by the Polish LMT firms within their resources is less likely to generate managerial upgrading. If interacting with global buyers in GVCs/GPNs and even the transfer of market-related knowledge through interacting with other actors in the market do not contribute, then what *does* contribute to eliminating the deficiencies of Polish LMT firms in managerial capabilities? This is a question that will be answered in the next sections.

b. Implications for process upgrading

Process upgrading is more likely to happen through contribution of learning from new advances in S&T and education. It is clear that the technological needs of the Polish food-processing and clothing firms centred primarily on upgrading their production process technologies, considering that the last technological improvements in most firms were conducted in the 1970s industrialisation period (Chapter 5). This means the modernisation of production facilities, machinery and equipment and the introduction of technological advances in the industries. Technology purchases in the LMT industries primarily meant the modernisation of the machine park of the firms and an increase in their productivity, both of which help in the process upgrading of the firms.

Process innovations in LMT industries are expected to come not only from technology suppliers (AL relations), but also from organisations that deal with scientific research and firms in high-tech industries such as advanced materials and agri-business (knowledge networks). As Chapter 7 showed, learning from advances in S&T is strongly associated with technology-related knowledge (technological and scientific knowledge as well as knowledge on process technology), and knowledge transfer was unidirectional. Based on this background information and the regression results, it appears that Polish food-processing and clothing firms upgraded their process technology through relationships that led to learning from new advances in S&T in the early 1990s as compared to mid- and late 1990s. This result shows that however weak the S&T system was (Chapter 5), and in spite of their financial difficulties, these firms had recourse to sources around them, such as knowledge networks with universities and public research institutes. Then they got into contact with foreign technology suppliers, giving priority to the most urgent upgrading of their process technologies through arm's

length relations. The indirect effect of global buyers (in GVCs) in these firms' process upgrading lies in the *investment inducement* as suggested by Ernst (1997) (section 2.2.3.2), sometimes as a direct requirement from the global buyer before starting a business with the Polish firm and sometimes as a result of competitive pressures with domestic and foreign rivals (such as Southeast European or East Asian countries). For instance, the stronger market leaders among the clothing firms have had their own CAD systems since the early 1990s, as they learnt from their OPT relations at the time and introduced automatic cutting machines in the mid-1990s.

However, most of these relationships have not been pursued (they remained one-off relations). First of all, they had once upgraded their major process technologies in the early 1990s, though constrained by financial difficulties, the Polish firms focused on the gradual upgrading of their out-dated machinery and equipment over the period this research is looking at. Therefore, instead of trying to renew their core technologies with the purchase of newest available machinery and equipment in a short time period, they prioritised learning about technological developments in particular technologies through informal relationships (particularly Polish food-processing firms, section 7.5.2) and tried to learn how to apply them to their specialisation. Some of these relationships were only possible through one-off relationships targeting knowledge in a specific area that could only be obtained via relationship with a university or research institute (i.e. knowledge networks, such as research collaboration).

Another reason for one-off relations was related to foreign technology suppliers, who had entered the Polish market in the meantime and started marketing new products more aggressively, which meant firms did not need to search for them. This caused discontinuation of relationships with the original technology suppliers. Only in the cases where the firm has developed trust in the superiority of the technology by a particular technology supplier (that supplier may be the most well-known or reputable in its niche market) or has been satisfied with its after-sale services over the years, then the firm tended to upgrade its process technology through the same technology supplier.

Last but not least, we have to remember that Polish firms were functioning simply as production units prior to transition. The new advances in S&T were provided to them to use, so they did not have to search for or create them (i.e., the divorce between

production and R&D under socialism as discussed in Chapter 5). Just as new knowledge in a familiar area is absorbed more easily than in an unfamiliar area, learning from advances in S&T was more familiar to Polish firms for improving their production processes than other learning mechanisms, and therefore easier to implement for the benefit of firm-level upgrading. The easiest route to upgrading seemed to be to upgrade the out-dated production processes and technologies. It was also most needed. Therefore, learning from advances in S&T became the most appropriate learning mechanism used by the Polish LMT firms during relationships in the early 1990s - this seems to be a very practical solution to match the learning capacity and the needs of the firm for process upgrading. Although focusing first on the process upgrading is desirable in the context of emerging market firms, it is still difficult to judge whether Polish food-processing and clothing firms are successful cases of catching-up.

c. Implications for product upgrading

Product upgrading has benefited from three of the learning mechanisms in networks, indicating a strong emphasis on the knowledge and technology acquired externally for product upgrading. The contribution of learning from advances in S&T to product upgrading is not very surprising. It seems natural in LMT industries that the acquisition of new process technologies generally precedes the development of new products, as technology and product dimensions are strictly interrelated (Nicholas 1996, von Tunzelmann and Acha 2005). In the early 1990s, they initiated arm's length relations and knowledge networks, actively sourcing for new knowledge, and what they learned from these new advances not only contributed to their process upgrading but also to their product upgrading. Recalling the results of Witt and Zellner (2009), the results show that firms seem to have benefited not only from new process technology but also from access to the scientific expertise and advice as well as technological knowledge in development of new products. As discussed in Chapter 7, the food-processing firms are more likely to learn from advances in S&T. In my interviews with Polish food-processing firms, the interviewees said that their firms developed knowledge networks with universities and research institutes that aimed at new product development (e.g., dairy company and fruit and vegetable preserves company with domestic partners, meat processing company with foreign partners). However, the findings for product upgrading show that food-processing firms are one-half as likely to upgrade their products through their relationships as clothing firms. For food-processing firms, these

knowledge networks as a source of new product development are not as effective as sources for product development used by the clothing firms; these are interacting with global buyers within production and distribution networks and knowledge spillovers readily available through these networks (as the results of interaction model of learning shows, section 7.5.2). This finding is in line with the upgrading literature that postulates GVCs/GPNs link local firms, in this case Polish firms, to international product movements. The contribution of learning from knowledge spillovers to product upgrading is also in line with the argument on the effect of spillovers in the form of reverse engineering (observation, imitation and adaptation) on new/similar product development (Mowery and Oxley 1995), and through product design specification, involvement in prototype development, informal sharing of technical and marketing information on customer's products (Ernst 1997).

d. Implications on functional upgrading

Functional upgrading is also more likely to happen through learning from knowledge spillovers and learning by interacting during the relationship. Relying on the results of LM in Chapter 7 (Table 7.4), common characteristics of these learning mechanisms are the significant and positive effects of the foreign partner and mobility of people in the relationship.

As in the case of product upgrading, GVCs/GPNs appear to have significant bearing on the Polish LMT firms' acquisition of new functions such as increasing process and product quality; and of new capabilities in the areas of raw material procurement, design and marketing. Hence, the positive and significant effect of learning by interacting on functional upgrading provides strong evidence for learning facilitation effect of GVCs/GPNs at least up to ODM level (Hobday 1995a, 2003, Ernst 1997, Lee and Chen 2000, Yoruk 2004, Kishimoto 2004), and provides evidence against the claims that GVCs/GPNs hinder functional upgrading (Navas-Aleman 2011, Bazan and Aleman 2004, Bair and Gereffi 2001, Kaplinsky *et al.* 2002, Schmitz and Knorringa 2000, Humphrey and Schmitz 2000, Gibbon 2000).

From the chain perspective, Schmitz (2006) argues that most often the firms that achieve functional upgrading through learning in GVCs/GPNs are able to do so up to the ODM level of Hobday's 'stages model' (1995b, 2003), a learning trajectory of

OEM-ODM-OBM that shows the importance of incremental and minor improvements for catching up or keeping up with developed country firms (see section 2.3.2.1). As discussed in Chapter 6, a similar pattern in the Polish clothing industry was found where firms achieve being ODM for both the domestic and export markets while working as OEM for the global buyers. The large Polish clothing firms that were interviewed in this research were all operating in multiple chains. Contrary to the experiences of clothing firms in other emerging markets, even after being integrated into GVCs, in Poland the large brand manufacturers of the communist era have never abandoned their national market (see section 6.3.1 – they had their own well-known reputable brands, etc.).¹⁸² So, overall, being inserted into GVCs as OEMs was seen as ‘downgrading’ when the communist system collapsed; and yet becoming an ODM for the export market (e.g. retailers, buyers without manufacturing expertise, ex-manufacturers) over the years is regarded as a functional upgrading since the design capabilities of these firms during the communist regime had been close to none. The Polish clothing firms quickly understood that today the competitive edge of the clothing industry hinges not on machinery, but mostly on design skills, choice and use of new fabrics, meeting quality standards, development of marketing and distribution systems and efficient organisation of production stages/lines in addition to achieving competitiveness in hardware by investing in new machinery, new production lines, and computer systems – all of which are the fruits of growth and/or management of knowledge within the firm (Penrose, 1995) and necessary for leverage in the foreign markets. The competition from the suppliers in low-cost countries made them react to the requirements of their partners for greater flexibility, quick response and service which in turn not only improved their relations with their partners but also led to improvements in organisational capabilities of the firm (Chandler 1996).

Based on these experiences, the Polish clothing firms developed confidence quicker than expected to rejuvenate their reputation as OBMs in their domestic market. As network organisers appeared in the domestic market, they had also become ODM both in the domestic and foreign markets with stronger design capabilities. Therefore, such functional upgrading is partly related to the insertion in GVCs, partly a consequence of

¹⁸² While the share of this function in total production decreased with OEM being inserted in, it was more profitable compared to OEM and the firms were aspiring to increase its share gradually (based on my interviews).

increasing role of global buyers without manufacturing expertise and partly is a path-dependency.¹⁸³ In this sense, the route of functional upgrading of Polish clothing firms that operate in multiple chains provide a different and complex case compared to existing cases in the literature (Yoruk 2004).

Through GVCs, they quickly realised where the market niches were in their specialisation and what they needed to do to improve their presence in the domestic market. GVCs, in other words, proved to be short-cut to information about the fashion markets, quality supply markets, design patterns and so on. They first understood the importance of new designs in every season for product differentiation moving beyond the standardised clothing of the socialist era (even in men's suits, a clothing category which differentiation was particularly undervalued). Then they realised that the quickest way to improve their presence in the domestic market is to imitate the designs of global buyers. Quality improvements through use of foreign fabric suppliers were introduced, due to the low credibility of Polish suppliers as a result of the collapse of Polish textile industry. At the same time, global buyers brought the information where the best quality foreign suppliers were and sometimes established a bargain price, of which Polish clothing firms made use to supply their own products while making purchase for the production of the global buyer. Finally they realised the importance of having their own designers - initially external ones, later followed by development of their own in-house design capabilities.

There were two obstacles to achieve all these steps towards functional upgrading. First, as mentioned earlier (in section 8.5.1.3), global buyers establish barriers to prevent their suppliers from encroaching on their core competences, and second, the realisation of these steps was easy for the managers who were in the clothing industry for long years but was not enough and rewarding when they were in financial dire straits to implement all of them, particularly big steps, such as marketing in foreign markets, that require strong financial standing and substantial risk-taking. Like many emerging market firms, Polish clothing firms supported their functional upgrading in developing design capabilities, quality improvements and marketing and distribution in the domestic market through their earnings from the OEM production (whose share in production

¹⁸³ Yoruk (2004) explains the background for this achievement.

was always more than the share for their own production lines); even if it meant low profit margins, it was a safeguard until they re-established their brands, at least in the domestic market. In other words, for large Polish clothing firms which aspired to become like the global buyers, GVCs served as a source of finance for first survival and then for the investments in resources needed for functional upgrading (*investment inducement* of Ernst 1997).

As this thesis argues from the beginning, it would be misleading to restrict ourselves only to chain approach to explain functional upgrading. In addition to *learning facilitation* effect of GPNs/GVCs, functional upgrading becomes a result of *knowledge spillover effects* through direct exposure to the foreign customer's system of managing production, distribution, marketing and R&D (Ernst 1997), and to the foreign retailers operating in the country. Hence, design capability can be acquired by means of GVCs (i.e. product specifications and designs provided by the global buyer as well as the specific production processes introduced by them), but how can the marketing and distribution capability be acquired through insertion into GVCs or just by selling products to small trading companies? As downstream activities, marketing and distribution have never been a part of the domain of suppliers in GVCs. They lie within the core competences of the global buyers which they did not need to share with their suppliers. Although their successful marketing, sales and distribution operations became exemplars to those suppliers who wanted to become like the global buyers in their domestic markets, to start with, they never had access to such tacit knowledge. This is where emerging market firms turn to other type of relationships in order to learn these new functions; these (based on my interviews) may include licensing, franchising of global brands for marketing and distribution in the domestic market, an alliance with a complementary firm to market products together at home or abroad, or working with a (foreign) consulting firm in order to initiate marketing. So, other network types play a role in functional upgrading by means of learning from knowledge spillovers in these relationships.

However, the fact that learning from advances in S&T does not increase the likelihood of functional upgrading suggests that complying with global quality standards through learning from advances in S&T (section 7.5.1.3) has no contribution to functional upgrading of the emerging markets firms. This is consistent with the work of upgrading

researchers (Quadros, 2004; Nadvi 2004). Why this is so constitutes a question for further research.

8.5.2 Internal Factors -Mediation Model of Upgrading Types (Upgrading Model 2)

Like UM.1, the Upgrading Model 2 (UM.2) was estimated through MLR to assess prediction of firm-level upgrading types. However, UM.2 is more about ascertaining the impact of factors internal to the firm as complementary to learning mechanisms external to the firm. As discussed in section 3.2.3 and described in section 4.5.2.2, internal factors that are complementary to external learning mechanisms and needed for successful internalisation of the externally acquired knowledge were operationalised with internal learning mechanisms (INTLEARN) and knowledge sharing levels within the firm (SHARING). However, a correlation between learning mechanisms external to the firm and these variables is expected (Baron and Kenney 1986). Table F.15 in Appendix F show the strong association between these independent variables (Pearson Chi-Square test, $p=0.000$). Hence, I suspect complementary internal factors to be *mediators* between learning mechanisms external to the firm and the types of firm-level upgrading. Therefore, UM.2 will check the predictive ability of these variables on the outcome types of firm-level upgrading after adjusting for the differences in the variable ‘learning mechanisms external to the firm’.

Following Baron and Kenney (1986:1177), I tested these two variables for mediation, by estimating three multinomial logistic regression equations:

“first, regressing the mediator on the independent variable; second, regressing the dependent variable on the independent variable; and third, regressing the dependent variable on both the independent variable and on the mediator”.

The first regressions for testing mediation showed that learning mechanisms external to the firm affect both learning mechanisms internal to the firm and level of knowledge sharing within the firm (Tables F.16.1 and F.16.2 in Appendix F). The second regressions for testing mediation showed that learning mechanisms external to the firm affect types of firm-level upgrading (this was the same as UM.1). The third regressions for testing mediation showed that learning mechanisms internal to the firm affect types of firm-level upgrading. The effect of external learning mechanisms on types of firm-level upgrading was lower in these regression results than in the second regression results (Table F.16.3 in Appendix F). The third regressions for testing mediation also

showed that levels of knowledge sharing within the firm affect types of firm-level upgrading, though not as strongly as internal learning mechanisms; and the effect of external learning mechanisms on types of firm-level upgrading does not reduce in the third regression results compared to the second regression results. Therefore, based on the tests for mediation of these two variables, I found learning mechanisms internal to the firm constitute a successful mediator caused by external learning mechanisms while knowledge sharing levels within the firm are not, and should simply be treated as an independent variable.¹⁸⁴

In addition, UM.2 with zero restrictions (using stepwise method of backward elimination for selection of variables) is also compared with the full specifications model without any restrictions imposed on its coefficients (i.e. forced entry of all variables included in the model is used), and the result did not qualitatively affect the estimates of the coefficients that were not set to zero in UM.2. In general, the log-likelihood of the UM.2 and the magnitude of the coefficients have not changed, $\chi^2(4, 467) = 3.77, p > 0.250$, indicating that the model without zero restrictions is no better than the model with zero restrictions. Hence, UM.2 that is estimated through stepwise method was preferred. The results of fitting full specifications model and the restricted model are displayed comparatively in Table F.17 in Appendix F.

8.5.2.1 Overall Model Fit

Before examining the estimates, the overall fit of the models was assessed. As Table 8.4 displays, the χ^2 values of both models decisively reject the null hypothesis ($p < 0.001$), which means the models have greater explanatory power than a ‘constant only’ model.

Comparison of log-likelihood ratios for UM.1 and UM.2 showed statistically significant improvement with the addition of variables that operationalise complementary internal factors to learning mechanisms external to the firm, $\chi^2(16, 467) = 208.24, p < 0.001$ (a highly significant probability value), indicating that these variables, as a set, reliably predict contribution of relationships to firm-level upgrading types. So, I prefer UM.2 to UM.1.

¹⁸⁴The test results are presented in Appendix F, Tables F.16.1, F.16.2 and F.16.3.

Moreover, the overall correct classification improved from 44% to 53% with the addition of these variables. Pseudo R^2 (McFadden)¹⁸⁵ for UM.2 was 0.270, which improved from 0.128 of UM.1, suggesting the variables in UM.2 explain 27% of the variability in upgrading types. Higher Pseudo R^2 (McFadden) for UM.2 compared to UM.1 also confirms that the variables for internal factors complementary to learning mechanisms external to the firm are important factors in contributing to types of firm-level upgrading.

There are no inordinately large parameters or standard errors, no indication for a possibility of a problem of empty cells or evidence for multicollinearity in UM.2 (Hosmer and Lemeshow 2000, Tabachnick and Fidell 2007, Petrucci 2009).

The likelihood ratio tests of each estimated variable show that each of the variables has some association ($p < 0.25$) with the outcome types of firm-level upgrading, except INDUSTRY. It was neither significant ($p = 0.438$) nor a confounder when added to the main effects model (i.e. UM.2 full specifications model) in Table F.17 in Appendix F. It was eliminated by the stepwise selection method.

Next, the estimates from the four logit functions of UM.2 were made using Table 8.4, which shows the regression coefficients, the statistical significance of Wald χ^2 tests and standard errors in parenthesis.¹⁸⁶ To remind, the first logit function compares the contribution of the relationship to managerial upgrading with no contribution to any type of upgrading, the second logit function compares the contribution of the relationship to process upgrading with no contribution to any type of upgrading, the third logit function compares the contribution of the relationship to product upgrading with no contribution to any type of upgrading, the fourth logit function compares the contribution of the relationship to functional upgrading with no contribution to any type of upgrading.

¹⁸⁵ As Borooah (2002:57) reports from the survey of pseudo- R^2 measures by Veall and Zimmerman (1996), in multinomial logit models, as a measure of effect size for a model, as compared to Nagelkerke and Cox and Snell tests, only the McFadden (1973) measure “seemed worthwhile”. Being a transformation of the likelihood ratio statistic, it is the closest approximation mimicking an R^2 in multiple linear regression. It is a measure bounded in between 0 and 1 (Borooah 2002: 57, Tabachnick and Fidell 2007: 460), and “values in the 0.2 to 0.4 range considered highly satisfactory (Henscher and Johnson 1981)” (Tabachnick and Fidell 2007: 460).

¹⁸⁶ The more detailed results tables with odds ratios and the 95% confidence intervals around them can be found in Table F.17 in Appendix F.

8.5.2.2 *The Estimates*

Table 8.4 presents the results of UM.2 with the addition of internal factors complementary to learning mechanisms external to the firm (EXTLEARN) to predict the outcomes of one of the types of firm-level upgrading. With the results of UM.2, I observe the powerful mediating effect of internal learning mechanisms on the causal relationship between external learning mechanisms and types of firm-level upgrading. In other words, when internal factors for internalisation of externally acquired knowledge are controlled for, the previously significant relationship between learning mechanisms external to the firm and types of firm-level upgrading is no longer as significant.

Regarding the control variable, INDUSTRY was eliminated through stepwise variable selection method. Industry type was not a significant factor that changes the probability of types of upgrading within the firm. As mentioned above, contrary to LM in Chapter 7, time appears to be a significant factor, allowing us to observe the effects of change over time on the probability of different types of firm-level upgrading. I will discuss them one by one below.

Managerial upgrading versus no upgrading The estimation results of Table 8.4 (second column) show that time PERIOD has positive and significant effect on the managerial upgrading within the firm at 1% level, similar to the results of UM.1, yet with stronger effects. Compared to early 1990s, the relationships that started in the mid- and late 1990s were 11.6 and 26.5 times more likely, respectively, to contribute to managerial upgrading. This can be taken as an indication of Polish food-processing and clothing firms' increasing attention to the most required managerial upgrading within the firm as a result of the relationships started mid-1990s onwards and their awareness for taking advantage of these networking activities for their managerial upgrading.

Yet, statistically significant external learning mechanisms are still negative, indicating, as in UM.1, that learning by interacting was less likely to contribute to the managerial upgrading in the firm. When complementary internal factors in UM.2 are controlled for, this effect further reduces as the significance of learning by interacting improves from 5% level to 1% level. In addition, relationships that lead to learning from knowledge

spillovers appear to be less likely to contribute to managerial upgrading (at 10% significance level). Significant reduction in the already negative contribution of relationships that lead to learning by interacting and learning from knowledge spillovers to managerial upgrading can be explained by the statistically significant mediating effect (at 1% level) of the complementary internal factors for internalisation of external knowledge (as discussed above). More precisely, among other learning mechanisms internal to the firm, the relationships that create synergy for learning by training and research within the firm are 59.4 times more likely to contribute to managerial upgrading than the relationships that cannot create it and lead to no internal learning once knowledge is acquired externally.

Levels of sharing externally acquired knowledge within the firm are statistically significant at 1% level, but they negatively affect managerial upgrading. Sharing externally acquired knowledge within the unit and between units is 0.08 and 0.17 times more likely, respectively, to contribute to managerial upgrading than sharing such knowledge at all levels of the firm (or at divisional level if it is a group company). This indicates that managerial upgrading is rooted in the activities that concern the whole firm and requires a more holistic approach within the firm, rather than a top-down (or bottom-up) approach that involves, for instance, only the administration of the firm.

Process upgrading versus no contribution to upgrading

The estimation results of Table 8.4 (third column) show that, when internal factors complementary to learning mechanisms external to the firm are controlled for, time PERIOD is a significant factor that explains the process upgrading within the firm at 5% level, similar to the results of UM.1. Again, learning from advances in S&T and education is the sole significant learning mechanism external to the firm contributing to process upgrading within the firm. The presence of the mediating effect is understood not only by the reduction in the effect of learning from advances in S&T and education on process upgrading from 17.04 (odds ratio in UM1) to 13.65 (odds ratio in UM.2), but also with the significant positive effects of learning by training and research at 5% level and of knowledge sharing within the unit (at 1% level) and among people and different units within the firm (at 10% level) on process upgrading.

Learning by training and research within the firm is 6 times more likely to contribute to process upgrading. Similarly, sharing externally acquired knowledge within unit is almost 7.5 times, and among people and between units 3 times, more likely to contribute to process upgrading than sharing this knowledge at all levels of the firm by means of (generally) top or middle management. This finding does not support the argument based on the supplier-dominated nature of LMT industries. It extends our understanding of the level of absorptive capacity of LMT firms. The inclusion of internal learning mechanism sourced from search 'supply' and intensive sharing of the externally acquired S&T knowledge within the firm in the results of UM.2 indicates increasing levels of absorptive capacity (particularly with regard to technological knowledge, as this is the type of knowledge that is linked to learning from advances in S&T and education in Chapter 7). It means that engineering and production capability is exploited not only for the use of the new technology, and re-configurations or modifications of the new technology for domestic applications are done by putting effort into understanding and codifying the tacit components of it. Hence, this result implies that the LMT firm cannot simply be labelled as a 'user' of the technology purchased, of the outcome of the research project participated, and so on. In this sense, learning from advances in S&T and education seems to be complemented with internal factors that lead to efforts within the firm for technological capability development in Polish food-processing and clothing firms (albeit more in the form of product design and development than R&D), and not just a substitute for in-house R&D (Radošević 1999a).

Product upgrading versus no upgrading

The estimation results of Table 8.4 (fourth column) are similar to those of UM.1 and show that when internal factors complementary to external learning mechanisms are controlled for, time PERIOD that the relationship started has no significant effect on product upgrading. Learning mechanisms external to the firm are still significant factors that affect the odds of product upgrading within the firm (at 1% significance level); however, there is a reduction in the odds ratios of learning from knowledge spillovers (from 10.9 in UM.1 to 7 in UM.2) and of learning from advances in S&T (from 11.1 in UM.1 to 9 in UM.2), while the significance of learning by interacting disappears altogether. Two of the learning mechanisms internal to the firm have significant and positive effects on product upgrading, appearing as significant mediators between

external learning mechanisms to the firm and product upgrading. Particularly, relationships that lead to learning by training and research and learning by doing, imitating and failing are almost 15 and 9 times more likely, respectively, to contribute to product upgrading. Knowledge sharing at different levels within the firm has no significant effect on product upgrading, and hence is not considered as a mediator.

Table 8.4 Estimation results of multinomial logistic regression for UM.2

	Upgrading Model 2							
Variables	managerial upgrading		process upgrading		product upgrading		functional upgrading	
Constant	-1.73*	(0.96)	-1.68	(0.71)	-3.49***	(0.96)	-1.08*	(0.64)
<u>Time period</u>								
late 1990s (1998-2001) vs early 1990s (1989-1993)	3.28***	(0.93)	-0.86**	(0.43)	-0.05	(0.50)	0.95**	(0.47)
mid-1990s (1994-1997) vs early 1990s (1989-1993)	2.45***	(0.95)	-1.16**	(0.48)	-0.17	(0.54)	0.48	(0.51)
<u>Learning mechanisms external to the firm</u>								
learning from knowledge spillovers vs no learning	-1.17*	(0.61)	0.60	(0.51)	1.96***	(0.72)	0.03	(0.48)
learning from advances in S&T and education vs no learning	0.01	(0.66)	2.61***	(0.56)	2.20***	(0.83)	-0.54	(0.67)
learning by interacting vs no learning	-2.28***	(0.68)	0.29	(0.51)	0.88	(0.71)	0.33	(0.45)
<u>Learning mechanisms internal to the firm</u>								
learning by doing +imitating+failing vs no learning	-0.20	(0.69)	0.33	(0.49)	1.92***	(0.61)	-0.03	(0.44)
learning by using + monitoring vs no learning	0.49	(0.61)	0.47	(0.43)	0.84	(0.62)	0.04	(0.45)
learning by training + research vs no learning	4.08***	(0.81)	1.81**	(0.72)	2.70***	(0.84)	3.00***	(0.70)
<u>Level of knowledge sharing within the firm</u>								
within unit vs w ithin firm / divisional level	-2.59***	(0.58)	2.01***	(0.63)	0.49	(0.65)	-0.48	(0.53)
inter-personal / inter-unit vs w ithin firm / divisional level	-1.78***	(0.55)	1.16*	(0.65)	0.92	(0.63)	0.59	(0.50)
No of observations	467							
Log Likelihood	-354.774							
LR Chi-Square	395.685							
Degrees of freedom	40							
Prob > Chi-Square	0.000							
Pseudo R2 (McFadden)	0.270							
Correct classification	52.9%							
Variable Selection Method used:	Stepw ise (backw ard elimination)							
Variable removed from the MLR analysis:	INDUSTRY							
Reference outcome	No upgrading							
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.								

Source: Own dataset, SPSS version 17.0

Functional upgrading versus no upgrading

The estimation results of Table 8.4 (fifth column) are once again similar to the results of UM.1 and show that time PERIOD is positive and significant at 5% level, indicating that relationships that started in the late 1990s are 2.6 times more likely to contribute to functional upgrading than those started in the early 1990s. When the mediators are controlled for, the effect of learning mechanisms external to the firm on functional upgrading disappears altogether, indicating that ‘perfect mediation’ holds in the case of functional upgrading (Baron and Kenny 1986). More precisely, learning by training and research becomes the perfect mediator for functional upgrading because all the significant external learning mechanisms lose their effect on functional upgrading when internal learning mechanisms are controlled for. However, when I control for knowledge sharing levels within the firm to understand its mediating effect on functional upgrading, the mediator does not appear to be statistically significant. Hence, internal learning mechanisms, the sole mediator, become a significant factor in functional upgrading within the firm. More precisely, relationships that lead to learning by training and research within the firm are almost 20 times more likely to contribute to functional upgrading within the firm. Knowledge sharing at different levels within the firm has no significant effect on contributing to functional upgrading.

8.5.2.3 Discussion and Inferences

a. Managerial upgrading as a pre-requisite for functional upgrading

Time PERIOD appears to be an important contributory factor that makes a difference in the odds of managerial, process and functional upgrading within the firm. More precisely, the Polish LMT firms achieved process upgrading through relationships only in the early transition years, managerial upgrading through relationships since the mid-1990s, and functional upgrading since the late 1990s / early 2000s. These results are in line with the expected and realised outcome of privatisation and enterprise restructuring in the Polish manufacturing industry, which started in the mid-1990s, and represented a recovery for LMT industries, as discussed in Chapter 5. In addition, inflow of FDI gained momentum in the mid-1990s, particularly in the food-processing industry. When internal factors for internalisation of externally acquired knowledge are controlled for, the effect of time period on managerial upgrading became significant and positive also for the mid-1990s (i.e. in addition to late 1990s). This result suggests that in the mid-1990s, managerial upgrading started in its simplest form as a result of the introduction

of advanced management techniques such as use of ICTs at every level of the firm, computer-controlled systems in production processes and in warehousing. This seems reasonable when the intensive process upgrading activity of the firms through technology acquisitions in the early 1990s is remembered. Managerial upgrading then starts earlier than functional upgrading within the firm.

When the complementary internal factors to external learning mechanisms are controlled for, the effect of time period the relationships started on functional upgrading is indicative. Becoming a focus of the firms as late as early 2000s, relative to other upgrading types, functional upgrading emerges as a new type of upgrading within the Polish LMT firms, providing evidence that functional upgrading is not an automatic and natural result of being inserted in GVCs/GPNs as Gereffi (1999) puts forward. This result proves that functional upgrading requires accumulation of knowledge and capabilities specific for it, one of which is managerial capabilities (Penrose 1959); hence, as the results of the effects of time period on types of upgrading also show, the managerial upgrading preceding functional upgrading is no coincidence. Based on these results, managerial upgrading (a forgotten type of upgrading or an upgrading type that is taken as given) appears to be a pre-requisite for functional upgrading.

b. Mediating effects of internal factors

The estimation results of UM.2 (Table 8.4) show that the significant contribution of external learning mechanisms to the odds of upgrading types *reduces* when the internal learning mechanisms and the knowledge sharing levels within the firm are introduced and tested as mediators. These reductions are particularly significant in managerial and product upgrading, and in functional upgrading it reduces to zero (i.e. the contribution of external mechanisms disappears altogether). For these upgrading types, the major mediator appears to be learning by training and research.

More precisely, among the learning mechanisms internal to the firm, learning by training and research within the firm (once external knowledge is acquired through networks) appears to be the most significant contributor to all types of firm-level upgrading (the parameters are all positive and highly significant at 1% level, except process upgrading, significant at 5% level), making it a *potent condition* for external

learning mechanisms to affect all types of upgrading, except process upgrading (i.e. the impact of learning from advances in S&T and education on process upgrading does not change when internal factors are controlled for).

Although the association between process upgrading and learning by training and research is a significant and positive one, the latter does not hold a mediating effect on process upgrading. This may be related to the association between process upgrading and early 1990s. Against the time-related expectation for the possible impact of learning by training and research on types of upgrading in the emerging market firms (as mentioned in section 3.4.2), in the case of process upgrading, the effect of relationships that started in the early transition years on process upgrading may not be limited to guidance and stimulation by the externally acquired knowledge. So, it also does not indicate that firms had low level absorptive capacity in the firm or they were passive learners. On the contrary, the results indicate that they were internalising the externally acquired knowledge through learning from advances in S&T through learning by training and research, in line with the suggestion in the literature that ‘learning’ for effective assimilation of technology acquisition is essential for it to lead to catching-up or growth (von Tunzelmann 1995, Freeman and Soete 1997).

The results for the continuity of the relationship in LM of Chapter 7 might seem to contradict the results of UM.2 for process upgrading, because the former suggested that Polish LMT firms have one-off relationships in which they use the knowledge acquired through knowledge networks and arm’s length relations for learning from advances in S&T and education (section 7.5.1.3). However, that analysis was not a dynamic analysis, as the time period variable was eliminated. In UM.2 (when controlling for internal factors), there are indications that whatever the level of absorptive capacity for process upgrading within the firm in the early 1990s, it had gradually improved by the late 1990s, because when compared to the relationships that started in the early 1990s, the contribution of the relationships that started in the late 1990s to the likelihood of process upgrading has increased relative to that of relations started in the mid-1990s (see Table 8.4; also compare the coefficients and significance levels of the time period for processing upgrading in Tables 8.3 and 8.4). This is related to the need for modernisation in the early transition years (section 8.5.1.3 above).

It is the opposite for managerial and functional upgrading. In the early 1990s, due to low level of capacity for absorbing externally acquired knowledge regarding managerial and functional upgrading, the latter was not even a concern of the firm. When internal factors are controlled for, compared to the early 1990s, the contribution of the relationships started in late 1990s to the likelihood of managerial upgrading has increased relative to that of relations started in the mid-1990s, indicating improvement in the absorptive capacity of the firms for managerial upgrading by means of learning by training and research. When the relationships started in the late 1990s have significant and positive contribution to functional upgrading, as compared to those started in early 1990s and when learning by training and research becomes a perfect mediator, the result indicates that a high absorptive capacity of the firm for externally acquired knowledge increases the likelihood of functional upgrading. It is because the firm's awareness of a need to combine this knowledge with internal resources and capabilities improves by the late 1990s, and a conscious act of complementing external knowledge acquisition through production and distribution networks with active intra-organisational learning by training and research becomes necessary.

The finding on learning by training and research also extends the results of Szymanski *et al.* (2007: 446) who, with the analysis of the components of variance in return on total assets, found that "firm resources and internal organisation are the most important factors influencing profitability in the Polish food-processing sector". This is supported by the statistical evidence on the Polish food industry where staff training connected with innovation activities increased from 0.9% of the expenditures on innovation activities in 2000 to 2.6% in 2007 (Table 5.7 in section 5.3.3). Clearly for the transition period, this expenditure was below 1%. Our results not only support the view that ability to establish efficient organisation of the firm and to effectively use the resources requires skills that needs to be learned (Bell and Pavitt 1995, Teece 1996). They also demonstrate the importance of learning by training and research on firm-level upgrading *following* external learning of these skills during relationships.

On managerial upgrading

When complementary internal factors in UM.2 are controlled for, other things being equal, in addition to learning by interacting (UM.1), learning from knowledge spillovers during a relationship becomes *less* likely to contribute to managerial upgrading. The

relationship between these learning mechanisms external to the firm and managerial upgrading is mediated by learning by training and research.

Common characteristics of these learning mechanisms were the relationships with foreign partner and mobility of people in the relationship (the results of LM in Chapter 7 in Table 7.4). According to our results, contrary to the expectations, knowledge spillovers in general contributed nothing to managerial upgrading in Polish LMT firms. As discussed earlier in section 3.3.1, spillover effects are not reserved only for FDI; there are involuntary knowledge spillovers from global buyers in GVCs in managerial practices (Ernst 1997, Saliola and Zanfei 2009). For instance, earlier, I found that there are knowledge spillover effects from global buyers in the clothing industry (section 7.5.2.3). However, as opposed to the findings of Gentile-Lüdecke and Giroud (2009) in Polish automotive industry, in the food-processing and clothing industries, this research found that as well as learning by interacting, learning from knowledge spillovers also impedes managerial upgrading within the firm. So, when the internal factors are controlled for, the contribution of these learning effects from spillovers in GVCs/GPNs, even in clothing firms, are not observed; however only with regard to *managerial* upgrading (as such learning *does* contribute significantly to product upgrading; section 8.5.1.3.c). This may be related to the industries studied being low- to medium-tech industries in particular, in which case FDI spillovers do not contribute to upgrading as much as in high-tech industries, confirming the findings of Weresa (2004). However, when the LMT industries are compared among each other (as will be the case in the interaction model below, section 8.5.4.2), this effect shows significant differences between low-tech and medium-low-tech firms.

Managerial upgrading also seems to be internally-driven with apparent obstacles created by the foreign partners in production networks and value chains. This requires strong internal incentives and effort, almost always by the management itself, since learning in networks impedes this form of upgrading more than it contributes.

On product upgrading

When internal factors complementary to external learning mechanisms are controlled for in UM.2, compared to UM.1, the strong positive effects of learning from knowledge

spillovers and learning from advances in S&T and education on product upgrading are reduced, while that of learning by interacting disappeared. In other words, other things being equal, learning by interacting during a relationship is *not* likely to contribute to product upgrading any more. The reduction in the significance and even the loss of significance of the effect of learning mechanisms external to the firm on product upgrading is a result of the learning by doing, imitating and failing and learning by training and research being potent conditions for this effect to occur. As suggested by the earlier findings, this result indicates there is a link between learning by doing and learning by interacting (GVCS/GPNs) for product upgrading.

The combined effect of the contribution of learning from knowledge spillovers and learning by doing, imitating and failing to product upgrading is significant as it shows demonstration effects (i.e. imitation) to be a spillover channel (Mowery and Oxley 1995, Günter 2005) from foreign firms in their environment or as partners in relationships. It means that Polish food-processing and clothing firms mimicked foreign firms in product development, differentiation and product marketing strategies. In order to do so, they also intensively train their staff to improve internal resources and capabilities; however, due to lack of internal expertise, they source knowledge externally from departments of universities as well as specialised consulting firms that provide the type of education and training needed by these firms at the time. From technology transfer point of view, this result means demonstration, observation, imitation and application of technologies, as Mowery and Oxley (1995) discuss, albeit only in product improvement and development and not in management techniques or process technologies. Moreover, since the contribution of learning by using is not significant, technology transferred in arm's length relations does not appear to be the main source of knowledge spillovers that lead to imitation. Still, this result shows that there is endogenisation of technical / technological knowledge by imitation, which leads to higher opportunities for competence-building and therefore product upgrading.

On functional upgrading

It has not been fair to expect that getting involved in GVCs/GPNs would eventually lead to functional upgrading, and in fact, as mentioned earlier, the literature has controversy over whether insertion into GVCs provides a route to functional upgrading (Schmitz 2006). Would this confusion be due to focusing only on moving into new

functions in the ‘chain’? There are functions that firms upgrade, which are not related to chain activities. There are other types of networks that may lead to functional upgrading such as the knowledge networks this thesis studies. Can the answer be the impact of involvement in other kinds of relationships than chains as well as operating in multiple value chains?

The case studies in the upgrading literature posit that local firms that operate in market-based chains in the (large) domestic or regional markets¹⁸⁷ are able to achieve functional upgrading because they experience neither support for nor blockage to upgrading (Hsing 1999, Bazan and Navas-Aleman 2004, Schmitz 2006, Navas-Aleman 2011). These case studies also show that working with small buyers facilitates functional upgrading (Tewari 1999); “[h]owever, local producers do not necessarily make the required investment for functional upgrading” (Schmitz 2006: 560). Moreover, Schmitz (2006) argues that the chain approach cannot explain the underlying reasons why they sometimes are able to functionally upgrade and sometimes not. Earlier UM.1 tried indirectly to answer what type of chains and relationships facilitate functional upgrading using the learning mechanisms external to the firm as the sole independent variable, whose network-related determinants were examined in Chapter 7. This analysis did not provide support to the finding of these abovementioned case studies that arm’s length relations contribute to functional upgrading. It may be because our sample consists of firms that operate in a wide range of multiple chains and networks such as being OEM and ODM for foreign customers, being OBM in their domestic market and being OEM/ODM for network organisers/retailers in their domestic market as well as being involved in knowledge networks. In this research’s analysis, more than supporting functional upgrading, arm’s length relations are associated with technology transfer purposes which lead to process upgrading (and, as a result of process development, product upgrading) when compared to production and distribution networks.

Our results in UM.2, however, contribute to this discussion from the evolutionary perspective rather than chain approach. They complement the missing part in the

¹⁸⁷ In the terminology of this research, this is similar to OBM in the domestic markets and ODM in export markets, e.g., with retailers who buy the design of the Polish supplier and sell it under its own brandname (see Schmitz 2006:559 for the definition of market-based chains).

puzzle, particularly in an upgrading type which is based on acquiring new capabilities and using organisational routines to pursue new opportunities in the market. Earlier findings in the upgrading literature suggest that being inserted in GVCs/GPNs and learning by interacting with global buyers are not sufficient for functional upgrading, and arm's length relations of local firms may contribute but resource requirements are so high that there is lack of investment. Recent work argues that functional upgrading is all about acquiring new skills and capabilities that are new to the firm (Navas-Aleman 2011); however, this acquisition is still overlooked under the generalisation of investments for resources. The literature focuses mostly on the financial side of the internal efforts that are undertaken by the firm for functional upgrading. It is true that they are costly investments. However, a striking fieldwork observation from Polish clothing firms sheds lights on why it is not related to the expenditures needed for investments. As this research examines large firms with better financial standing compared to SMEs in clusters, among the firms I interviewed that had the financial capacity to finance the investments for becoming network organisers / lead firms of DPNs for own brands to be sold in the domestic market (i.e. in the way GVC/GPNs were governed), three of them made these investments, but still failed. It was clear that they did not have the managerial capability to support their functional upgrading to govern a big network of suppliers, and they did not have the design capability in the areas that were not their core competence (e.g. a well-known overcoat producer attempted to design light dresses for women). Did they not invest in design capabilities enough? Did they not have the best managerial practices?

So, what completes the contribution of learning in value chains and production networks to functional upgrading? Different from the upgrading literature, this research throws light on this question by examining the "internalisation of the external knowledge" that is needed to acquire new capabilities within the firm for successful functional upgrading, even without extra cost when intra-organisational learning mechanisms are employed as a complementary internal factor to inter-organisational learning mechanisms. My interviews show that Polish clothing firms that achieved successful functional upgrading to OBM in the domestic market and ODM in the export market built their success on the internalisation of knowledge they acquired while in GVCs / GPNs. Firms that tried to establish such functional upgrading based on externally hired capabilities have failed, as some examples given above show.

Our estimation results in UM.2 support this observation. When internal factors for internalisation of externally acquired knowledge are controlled for, other things being equal, neither learning by interacting nor learning from knowledge spillovers had an effect on functional upgrading (as opposed to the results in UM.1), while external knowledge acquisition that leads to learning by training and research within the firm had significant (at 1% level) and positive effect on the probability of functional upgrading, indicating *perfect mediation* of learning mechanisms internal to the firm. This means that learning by training and research is the single, dominant mediator to account for the relationship between learning mechanisms external to the firm and functional upgrading. In other words, the strong and effective presence of learning by training and research within the firm is the cause of learning by interacting and learning from knowledge spillovers during the relationships. In contrast to Navas-Aleman (2006, 2011), who finds functional upgrading happens in firms that learn in their market-based relationships at national level, this result indicates that whether the knowledge comes from GVCs/GPNs or from market-based relationships, the internal dynamics of the firm is the main stimulus for successful functional upgrading. The latter is about being an active learner, being aware of the need to combine externally acquired knowledge with internal resources and capabilities and high levels of absorptive capacity within the firm for internalisation of the externally acquired knowledge (the latter is an issue that is strongly related to managerial upgrading). In other words, passive learning mechanisms internal to the firm such as learning by doing or learning by using do not contribute to functional upgrading within the firm. Therefore, this finding suggests that it is not that no learning about branding, design and marketing among domestic firms takes place through GVCs/GPNs (as discussed by the GVC perspective to upgrading), but there are issues concerning how effective this external knowledge is internalised.

c. Levels of knowledge sharing within the firm

Our results about the contribution of the levels of sharing externally acquired knowledge within the firm to upgrading types reveal that process upgrading benefit from knowledge sharing within the unit as well as between people and among the units. This is strong evidence for spiral of organisational knowledge internalisation once external learning was achieved, but only in process upgrading (cf. Nonaka's (1994) spiral of organisational knowledge creation as mentioned in section 4.5.2.2).

Managerial upgrading benefits from knowledge shared at all levels of the firm, as reflected in our results on the significant but negative contribution of knowledge sharing at unit and inter-unit levels as compared to all levels of the firm. Perhaps as part of the heritage from communist era, managerial upgrading within the domestically-owned firms is still a top-down process, rather than bottom-up, or perhaps this is a result of continuing enterprise restructuring, delayed privatisation and the emerging role of strategic investors in the firms due to the time period investigated. However, it appears to be related to the results showing that learning mechanisms external to the firm are less likely to contribute to managerial upgrading. The smaller likelihood of managerial upgrading through inter-organisational learning seems to be compensated with internal knowledge sharing mechanisms at all levels of the firm. This makes sense when the learning by training and research is also a significant and positive contributing factor to managerial upgrading within the firm.

It is surprising to find that sharing externally acquired knowledge at different levels within the firm has no significant contribution to product and functional upgrading types. A further research question would investigate whether it would be because of their link to process and managerial upgrading respectively, as discussed earlier.

8.5.3 Strategy Model of Upgrading (Upgrading Model 3)

This section investigates the effect of firm strategy towards relationships on types of firm-level upgrading, seeing this strategy as an internal factor on its own right that is expected to affect firm-level upgrading. It originally answers the sub-question of how the strategy orientation of the firm for access and optimal use of the external knowledge affects firm-level upgrading. It is investigated by looking at whether the variable STRATEGY significantly enhances prediction of outcome of types of firm-level upgrading after adjusting for the differences in the variables concerning learning in networks (i.e. UM.2).

8.5.3.1 Overall Fit

Before interpreting the estimates, the overall fit of UM.3 was assessed briefly. As Table 8.5 display, the χ^2 value of UM.3 decisively reject the null hypothesis ($p < 0.001$), which

means the models have greater explanatory power than a ‘constant only’ model. The overall correct classification of both models was around 53%. Pseudo R^2 (McFadden) value was 0.286, which improved from 0.270 in UM.2, suggesting the variables in UM.3 explain 29% of the variability in types of firm-level upgrading. The standard errors in UM.3 were below 2, indicating no evidence for multicollinearity (Tabachnick and Fidell 2007, Petrucci 2009). The likelihood ratio tests of variables show strong association ($p=0.000$) with the outcome of types of firm-level upgrading, except INDUSTRY.

Comparison of log-likelihood ratios for models with and without the STRATEGY variable (UM.2 versus UM.3) showed statistically significant improvement with the addition of STRATEGY variable, $\chi^2(4, 467) = 23.49, p < 0.001$ (a highly significant probability value), indicating that STRATEGY variable reliably predicts types of firm-level upgrading.

In the following sections, the estimates from the four logit functions of UM.3 were made using Table 8.5, which shows the regression coefficients, the statistical significance of Wald χ^2 tests and standard errors in parenthesis.¹⁸⁸

8.5.3.2 *The Estimates*

The logistic regression estimates of UM.3 presents a model in which STRATEGY variable is added to the UM.2 (Table 8.5 and Table F.18 in Appendix F for a detailed version). Examining the significance of Wald χ^2 tests, I observe that estimates of the independent variables in UM.3 do not show any significant difference from the estimates of UM.2.

Strikingly, the additional effect of the variable STRATEGY in UM.3 shows that the coefficient of the firm strategies is positive and statistically significant for all types of firm-level upgrading, except for functional upgrading (at 1% level for product upgrading, at 5% level for process upgrading and at 10% level for managerial upgrading). More precisely, competence-oriented firm-level upgrading strategy is

¹⁸⁸ The more detailed results tables with the odds ratios and the 95% confidence intervals around them can be found in Table F.18 in Appendix F.

estimated to be 2.5, 2.4 and 3.4 times more likely to lead to managerial, process and product upgrading respectively than competition-oriented firm-level upgrading strategy. Thus, from a statistical point of view, firm strategies are significantly associated with the types of firm-level upgrading as one of the network-related sources of it.

8.5.3.3 Discussion and inferences

The Polish LMT firm's strategic orientation regarding the use of the knowledge acquired through networks the firms were involved in exert a significant effect on the likelihood of their upgrading. In other words, upgrading comes as a result of effective learning realised during relationships by the help of systematic strategy pursued.¹⁸⁹ When compared to competition-oriented firm strategies, competence-oriented upgrading strategies significantly increased the likelihood of product, process and managerial upgrading. Networks have become an important means to Polish LMT firms to learn the knowledge, technology and skills that are not available in-house so as to understand the new trends in their markets, the new technologies of their production processes, and to develop their strategic orientation accordingly towards building competence for successful upgrading possibilities.

This result especially indicates that the relationships these LMT firms participated in during the transition years have led to an understanding of the importance of competence building and leveraging to eventually improving these firms' competitiveness in future product and resource markets with regard to the issues of quality rather than quantity. Quality improvements have been the major issue in the CEECs after transformation. So, it is not striking that this result indicates an emphasis on competence-building as firm strategy by the Polish LMT firms, since low quality problem leads to the need for serious investments in human capital in all upgrading types. In other words, it shows that Polish LMT firms were following the new advances in S&T, getting better equipment through arm's length relations in the market, new developments in demand in the domestic market and new requirements for managing competitiveness, as mentioned in section 1.2.2, through searching, exploring, gathering

¹⁸⁹ This refers to the virtuous cycle between the concepts mentioned in the analytical framework in Figure 3.1: The relationships help Polish LMT firms to gain new perspectives on determining their firm strategy for upgrading purposes, which are later pursued systematically to get involved in networks that will lead to more learning opportunities.

and using knowledge and technology available outside of the firm (von Tunzelmann and Acha 2005, Hirsch-Kreinsen *et al.* 2003).

Table 8.5 Estimation results of multinomial logistic regression for the additional impact of firm strategy

	Upgrading Model 4							
Variables	managerial upgrading		process upgrading		product upgrading		functional upgrading	
Constant	-1.91**	(0.98)	-1.81**	(0.72)	-3.82***	(1.00)	-1.05*	(0.64)
<u>Time period</u>								
late 1990s (1998-2001) vs early 1990s (1989-1993)	3.41***	(0.94)	-0.83*	(0.44)	0.11	(0.51)	0.91*	(0.48)
mid-1990s (1994-1997) vs early 1990s (1989-1993)	2.55***	(0.96)	-1.12**	(0.48)	-0.05	(0.56)	0.45	(0.51)
<u>Learning mechanisms external to the firm</u>								
learning from knowledge spillovers vs no learning	-1.49**	(0.63)	0.23	(0.53)	1.43*	(0.74)	0.06	(0.50)
learning from advances in S&T and education vs no learning	-0.24	(0.69)	2.38***	(0.56)	1.80**	(0.85)	-0.33	(0.68)
learning by interacting vs no learning	-2.44***	(0.70)	0.22	(0.51)	0.77	(0.72)	0.37	(0.45)
<u>Learning mechanisms internal to the firm</u>								
learning by doing +imitating+failing vs no learning	-0.17	(0.70)	0.38	(0.49)	1.99***	(0.62)	-0.05	(0.44)
learning by using + monitoring vs no learning	0.39	(0.62)	0.39	(0.43)	0.73	(0.62)	0.04	(0.45)
learning by training + research vs no learning	4.00***	(0.82)	1.64**	(0.73)	2.57***	(0.84)	2.99***	(0.70)
<u>Level of knowledge sharing within the firm</u>								
within unit vs w ithin firm / divisional level	-2.77***	(0.60)	1.95***	(0.64)	0.41	(0.66)	-0.36	(0.53)
inter-personal / inter-unit vs w ithin firm / divisional level	-1.86***	(0.55)	1.13*	(0.65)	0.94	(0.65)	0.60	(0.51)
<u>Firm upgrading strategy</u>								
competence-oriented vs competition-oriented firm upgrading strategy	0.92*	(0.47)	0.88**	(0.37)	1.22***	(0.42)	-0.27	(0.38)
No of observations	467							
Log Likelihood	-394.102							
LR Chi-Square	419.178							
Degrees of freedom	44							
Prob > Chi-Square	0.000							
Pseudo R2 (McFadden)	0.286							
Correct classification	53.3%							
Variable Selection Method used:	Stepwise (backward elimination)							
Variable removed from the MLR analysis:	INDUSTRY							
Reference outcome	No upgrading							
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.								

Source: Own dataset, SPSS version 17.0

These results also indicate the positive effects of learning in networks they are involved in as they do not present a short-termist approach to strategy development characterised by achieving high business performance. Although the firms in my sample were aiming at gaining competitive positioning among other firms by doing the same as for instance domestic lead firms / network organisers of the DPNs (based on my interviews), this result indicates that with a direction of competence-based strategies for upgrading, similar to Hamel's (1991) result, Polish LMT firms devote resources to distinguish themselves from other firms in their market and conduct an intentional learning process during relationships (most importantly through mobility of people and informal relations) in order to establish a strong foundation for long-term competitiveness.

The results of strategy-upgrading model also indicate that firm's strategic orientation for upgrading does not affect the outcome of functional upgrading within the firm. As opposed to what their Western counterparts were doing in the last decade (section 1.2.2), Polish LMT firms were not able to make a strategic shift to non-manufacturing activities as part of their upgrading strategies. This inability is not only expected in the transition years but also is compatible with the above result on the mediating effect of learning by training and research – they were still learning both externally and internally. The indications of such a shift are present in the results of UM.2 where functional upgrading appeared as an emerging type of upgrading in the late 1990s and early 2000s. This result is no coincidence, as it indicates that emerging market LMT firms were just awakening to the need to give strategic emphasis to non-manufacturing activities such as design, branding, marketing and distribution, moving from their core competence of production, where the sources of power in GVCs/GPNs are (Palpacuer 2000, section 2.2.3). Thus, it is understandable that orientation of firm strategy does not appear to have any impact on firm's functional upgrading in the transition years.¹⁹⁰

Hence, the underlying reasons for this appear to be related to the time lag due to the transformational recession the LMT firms experienced in the early transition years,

¹⁹⁰ Perhaps, as Hobday *et al.* (2004: 1438, footnote 13) states, “a firm may have a well-developed strategy but be weak in implementing the strategy. It is also possible that a firm may be very effective at innovating without a formal and well-developed strategy. The main point with respect to transition, is that successful transition does not only depend on the strategies of firms but in the changing circumstances surrounding firms, including the macroeconomic environment, government policies and competitor strategies”, which are not examined in this research and kept as part of its limitations due to the unit of analysis used.

when LMT firms were strategically focusing on regaining their competitiveness by means of learning business activities they did not know before the transition (as mentioned in section 6.3.1). Particularly in the mid-1990s with the increasing competitive pressures, i.e. when the presence of foreign investment increased in the food-processing industry and the low-cost supplier countries emerged in the clothing industry, firms were exposed to the risk of being crowded out in their domestic and export markets respectively (Dyker 2004b, Zukowska-Gagelmann 2000). Formally, this could mean the motivation of the firms in getting involved in relationships may differ across the industries due to these underlying reasons. Hence, why the relationships that started in mid-1990s became instructive for managerial upgrading of Polish LMT firms is also better understandable now (UM.1).

8.5.4 Industry-Interaction Models of Upgrading

The interaction models answer how much of the differences in upgrading types are due to *industry differences*. In this section, two interaction models are examined. One of them is based on the UM.1 to examine the interaction effect between industry types and learning mechanisms external to the firm on types of firm-level upgrading, and the other is based on the more comprehensive UM.3 with complementary internal factors and firm strategies. The latter model also checked the industry differences with regard to firm strategies.

8.5.4.1 Industry-Interaction Model of Upgrading based on UM1

In the industry-interaction model of UM.1 (I/UM.1), the interaction of INDUSTRY variable with the only independent variable, EXTLEARN, was run.¹⁹¹ The model was not acceptable due to unexpected singularities in the Hessian matrix, which required either exclusion of some variables or merging of some categories. Since there is only one independent variable, in whose impact this research is interested, merging categories of EXTLEARN variable was preferred to observe some impact. While deciding which categories of learning mechanisms in networks to merge, the MCA in Appendix F.1 was instructive. As suggested by Hosmer and Lemeshow (2000), the zero cells in the crosstabulations were also checked. The new categorisation combined learning by interacting with no learning to become one category that is also used as

¹⁹¹ The interaction of INDUSTRY variable with time variable, PERIOD, was eliminated from the model.

reference category against learning from knowledge spillovers and learning from advances in S&T in the new interaction model. Due to the strong association between learning by interacting and production and distribution networks, the use of learning by interacting as a reference category somehow meant to observe the effects of learning mechanisms in knowledge networks versus those in production and distribution networks.

a. Overall Fit

The χ^2 value of the I/UM.1 decisively rejects the null hypothesis ($p < 0.001$), which means it has greater explanatory power than a ‘constant only’ model. The overall correct classification is 43.3%. Pseudo R^2 (McFadden) for the I/UM.1 was 0.123, suggesting the variables in this model explain almost 12% of the variability in firm-level upgrading types. The likelihood ratio test of the interaction variable INDUSTRY*EXTLEARN (3 categories) was statistically significant at 1% level ($p = 0.001$). In the next section, the estimates from the three logit functions of I/UM.1 were made using Table 8.6, which shows the regression coefficients, the statistical significance of Wald χ^2 tests and standard errors in parenthesis.

b. The Estimates and Discussion

The estimation results of the interaction model (with three-category EXTLEARN) show significant differences from those of UM.1 (with four-category EXTLEARN) except in process upgrading. The interpretations of the two models differ with respect to the reference category; while in UM.1 comparison was done with no learning, in I/UM.1 comparison was done with learning by interacting and no learning. So, in I/UM.1 the effect of learning from advances in S&T on product upgrading disappears and, other things being equal, only learning from knowledge spillovers is 2.3 times more likely to contribute to product upgrading than learning by interacting or no learning during the relationship (significant at 10% level). Similarly, the effect of learning from knowledge spillovers on functional upgrading when compared to learning by interacting or no learning disappears, indicating no significant difference between these learning mechanisms external to the firm for increasing the likelihood of functional upgrading.

While when compared to no learning during a relationship, only learning by interacting was significant (at 5% level) and it was impeding managerial upgrading (UM.1), when

compared to learning by interacting or no learning during the relationship, learning from advances in S&T, other things being equal, became not only significant at 1% level but also 20 times more likely to contribute to managerial upgrading (than learning by interacting or no learning during a relationship). This result corroborates the emerging importance of high-technologies and ICTs in 'non-manufacturing' activities of LMT industries in Polish firms, particularly in the late 1990s early 2000s (von Tunzelmann and Acha 2005). Moreover, it indicates where the sources of managerial upgrading are: universities and consulting firms which provide training, certificate programmes and specialised courses in management and administration for firm employees.

The industry differences were observable only in the contribution of learning mechanisms external to the firm to managerial upgrading, namely the contribution of learning from knowledge spillovers to managerial upgrading of food-processing firms (when compared to learning by interacting or no learning during the relationship). The effect of learning from knowledge spillovers was positive and significant at 1% level, making this learning mechanism, other things being equal, 14 times more likely to contribute to managerial upgrading in food-processing firms than clothing firms.

When the determinants of learning from knowledge spillovers during a relationship from Chapter 7 are considered (LM), this result clarifies the role of foreign partners (in the form of foreign strategic investors and MNCs) in food-processing firms with whom informal relations were effective for spillovers compared to clothing firms (I/LM). The relations with the foreign investors most often were initiated by the investor and tended to be continuous, with lots of feedback and support. This result also substantiates the positive externalities from the strong presence of FDI in the Polish food-processing industry, where mobility of people (particularly in the form of transfer of people from MNCs to domestic firms) leads to spillovers that contribute to managerial upgrading in the domestically-owned food-processing firms. Moreover, as a result of the competition created by MNCs, the investments by foreign strategic investors, and the advancements in technology of food-processing industry, catching-up seems to be quicker by the Polish food-processing firms in managerial upgrading. So, in contrast to Jensen (2004) who found negative spillover effects from FDI in food-processing industry for 1993-2000, in managerial upgrading I found positive externalities from FDI to food-

processing firms in transition years (1989-2001) in comparison to learning by interacting (i.e. global buyers in GVCs/GPNs).

Table 8.6 Estimation results of multinomial logistic regression for industry differences for UM.1

	Industry-Interaction Model of UM.1							
Variables	managerial upgrading		process upgrading		product upgrading		functional upgrading	
Constant	-2.35***	(0.79)	0.41	(0.37)	-0.35	(0.43)	-0.04	(0.39)
<u>Control variable</u>								
food-processing vs clothing industry	0.20	(0.52)	-0.30	(0.46)	-0.81	(0.57)	0.10	(0.37)
<u>Time period</u>								
late 1990s (1998-2001) vs early 1990s (1989-1993)	1.85**	(0.80)	-0.72*	(0.41)	-0.07	(0.47)	0.74*	(0.42)
mid-1990s (1994-1997) vs early 1990s (1989-1993)	1.19	(0.83)	-1.15**	(0.45)	-0.32	(0.50)	0.10	(0.45)
<u>Learning mechanisms external to the firm</u>								
learning from knowledge spillovers vs learning by interacting andno learning	-0.63	(0.71)	0.00	(0.48)	0.84*	(0.44)	0.07	(0.41)
learning from advances in S&T and education vs learning by interacting andno learning	3.01***	(1.10)	3.65***	(1.05)	1.60	(1.19)	0.26	(1.25)
<u>Industry Interaction variables</u>								
Food-processing industry *learning from knowledge spillovers	2.67***	(0.94)	1.29	(0.80)	0.31	(0.90)	-0.16	(0.73)
Food-processing industry * learning from advances in S&T and education	-1.93	(1.27)	-1.22	(1.19)	-0.43	(1.40)	-1.40	(1.43)
No of observations	467							
Log Likelihood	-104.957							
LR Chi-Square	179.567							
Degrees of freedom	28							
Prob > Chi-Square	0.000							
Pseudo R2 (McFadden)	0.123							
Correct classification	43.3%							
Variable Selection Method used:	Stepw ise (backw ard elimination)							
Variable removed from the MLR analysis:	INDUSTRY							
Reference outcome	No upgrading							
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.								

Source: Own dataset, SPSS version 17.0

However, clothing industry not only receives relatively less foreign investment (mostly as traders than investors)¹⁹² but also the threat of re-relocation of production by foreign

¹⁹² See Terterov and Reuvid (2005) and my own interviews with major clothing brands that had moved (Adidas) or were about to move (Puma) their subcontracting activities from Eastern Europe to South East

buyers / lead firms leaves clothing firms in an insecure environment (as shown by the LM results above that the likelihood of managerial upgrading was impeded by learning by interacting and from knowledge spillovers during relationships). In sum, this is related to the industry differences with regard to the economic integration paths in CEECs (Kurz and Witke 1998) as mentioned earlier in section 4.3.1.

According to the results of I/UM.1, there are no differences between the two industries in the likelihood of process, product and functional upgrading with regard to learning mechanisms external to the firm when they are compared to learning by interacting and no learning.

8.5.4.2 Industry-Interaction Model of Upgrading based on UM.3

In the industry-interaction model of UM.3, the independent variables that interact with INDUSTRY variable were checked following Hosmer and Lemeshow (2000). It was based on the results of adding each interaction variable one at a time to the main effects UM to assess their significance using a likelihood ratio test (Table F.19 in Appendix F).¹⁹³ This meant running regressions of five separate models with interaction variables of industry type by variables of UM.3. The results of the likelihood ratio test of the statistically significant industry interaction variables at 10% level were INDUSTRY*SHARING ($p = 0.000$) (highlighted in italics in Table F.19). The other industry interaction variables indicated no or weaker association with the outcome variable, suggesting omitting these variables from the interaction model of UM.3 (due to strict adherence to the conventional levels of statistical significance). Nevertheless, using researcher's discretion, due to the fact that INDUSTRY is the main comparison ground of this research, all interaction variables with INDUSTRY, except the interaction variable INDUSTRY*EXTLEARN (which created unexpected singularities in the Hessian matrix as explained in section 8.5.4.1 above), are kept to create I/UM.3 as specified in section 8.3.

Asia by 2001 or were supplied by the headquarters and functioning as marketing and distribution regional headquarter for CEECs while using Poland as hub for this activity (Carli Gry).

¹⁹³ Since the estimates of these five models are not the main concern they are presented here; however, the likelihood ratios of the interaction variables added are of concern and presented in Table F.19 in Appendix F.

a. Overall Fit

The χ^2 value of I/UM.3 decisively rejects the null hypothesis ($p < 0.001$), which means it has greater explanatory power than a ‘constant only’ model. Comparison of log-likelihood ratios for UM.3 and I/UM.3 showed statistically significant improvement with the addition of industry interaction variables, $\chi^2 (16, 467) = 44.78, p < 0.001$ (a significant probability value), indicating that interaction variables reliably predict types of firm-level upgrading. In other words, overall fit of I/UM.3 is improved in comparison to UM.3. Yet, this does not affect the validity of the results of UM.3, since both models attempt to answer two different questions: To remind, UM.3 tried to answer how learning mechanisms external to the firm, the internal factors complementary to them and firm strategies affect types of firm-level upgrading and distinguished types of firm-level upgrading according to the specific sources that affect each one of them, while I/UM.3 attempts to answer to what extent these effects of learning mechanisms and other internal factors including firm strategies on types of firm-level upgrading *differ* between food-processing and clothing industries. In other words, with regard to the INDUSTRY type variable, UM.3 treated industry type as a variable that captured the effect of a particular industry compared to another directly on types of firm-level upgrading while I/UM.3 captures the effect of a particular industry compared to another on types of firm-level upgrading with regard to the selected variables of sources of upgrading.

The overall correct classification is 55%. Pseudo R^2 (McFadden) for I/UM.1 was 0.317, suggesting the variables in this model explain almost 32% of the variability in firm-level upgrading types. In the following sections, the estimates from the three logit functions of I/UM.3 were made using Table 8.7, which shows the regression coefficients, the statistical significance of Wald χ^2 tests and standard errors in parenthesis.

b. The Estimates

This section presents the logistic regression estimates of I/UM.3 (Table 8.7). Based on the stepwise method of backward elimination, the logistic regression estimation of the I/UM.3 eliminated the interaction of the INDUSTRY type with TIME PERIOD and INTLEARN, while it included the interaction variable of the INDUSTRY type with STRATEGY. This suggests an ability to differentiate between competence and

competition-oriented firm strategy towards relationships with regard to the industry type.

Examining the significance of Wald χ^2 tests, I observe that the estimates of the independent variables in the interaction model of I/UM.3 do not show significant difference from the estimates of UM.3, except the effect of the variable knowledge sharing levels within the firm on the likelihood of managerial and product upgrading. More precisely, the significant (at 1% level) and positive effect of both within unit and inter-personal / inter-unit relations on the likelihood of managerial upgrading disappeared, while inter-personal / inter-unit level of knowledge sharing within the firm is 10.6 times more likely to contribute to product upgrading than knowledge sharing at all levels of the firm (formal, top-down sharing).

When industry differences are controlled for, however, the difference between the two LMT industries appears to be in within unit sharing of externally acquired knowledge. It has significant (at 1% level) but negative effect on the likelihood of managerial upgrading, indicating that, other things being equal, the likelihood of managerial upgrading as a result of within unit sharing of externally acquired knowledge compared to sharing at all levels of the firm is 10 (1/0.099) times greater in clothing firms than in food-processing firms. This may indicate the differences in hierarchical structure of organisation within the LMT firms and their impact on types of firm-level upgrading, a further research topic to examine that is outside the scope of this research.

Moreover, when industry differences are controlled for, the positive effect of inter-personal / inter-unit level of knowledge sharing on the likelihood of product upgrading is also related to the clothing industry. This level of sharing externally acquired knowledge within the firm compared to sharing at all levels of the firm is 34.5 times more likely to increase the likelihood of managerial upgrading in Polish clothing firms than in food-processing firms. Conversely, the effect of the same knowledge sharing level on the likelihood of functional upgrading is 15 times greater in Polish food-processing firms than in clothing firms.

Table 8.7 Estimation results of multinomial logistic regression for industry differences for UM.3

	Interaction Model of UM.3							
Variables	managerial upgrading		process upgrading		product upgrading		functional upgrading	
Constant	-3.40	(1.24)	-2.40**	(1.08)	-5.50***	(1.48)	-0.35	(0.78)
<u>Control variables</u>								
food-processing vs clothing industry	1.66*	(0.94)	0.79	(1.26)	2.63*	(1.41)	-1.76*	(1.00)
<u>Time period</u>								
late 1990s (1998-2001) vs early 1990s (1989-1993)	3.62***	(1.00)	-0.81*	(0.45)	0.26	(0.54)	0.95*	(0.49)
mid-1990s (1994-1997) vs early 1990s (1989-1993)	2.78***	(1.02)	-1.13**	(0.49)	0.05	(0.58)	0.51	(0.53)
<u>Learning mechanisms external to the firm</u>								
learning from knowledge spillovers vs no learning	-1.59**	(0.67)	0.27	(0.54)	1.51**	(0.75)	0.03	(0.51)
learning from advances in S&T and education vs no learning	-0.16	(0.72)	2.59***	(0.59)	2.05**	(0.86)	-0.63	(0.71)
learning by interacting vs no learning	-2.17***	(0.69)	0.31	(0.52)	0.88	(0.73)	0.21	(0.46)
<u>Learning mechanisms internal to the firm</u>								
learning by doing +imitating+failing vs no learning	0.23	(0.71)	0.26	(0.50)	1.99***	(0.63)	-0.01	(0.45)
learning by using + monitoring vs no learning	0.63	(0.65)	0.40	(0.44)	0.77	(0.64)	-0.07	(0.47)
learning by training + research vs no learning	4.00***	(0.84)	1.53**	(0.74)	2.51***	(0.85)	3.17***	(0.71)
<u>Level of knowledge sharing within the firm</u>								
within unit vs w ithin firm / divisional level	-1.36	(0.85)	2.57**	(1.01)	1.68	(1.23)	-1.02	(0.69)
inter-personal / inter-unit vs w ithin firm / divisional level	-0.96	(0.76)	1.91*	(1.00)	2.36**	(1.17)	-0.34	(0.63)
<u>Firm upgrading strategy</u>								
competence-oriented vs competition-oriented firm upgrading strategy	1.47**	(0.62)	0.97**	(0.49)	1.81***	(0.53)	-0.15	(0.50)
<u>Industry Interaction variables</u>								
Food-processing * within unit	-2.31*	(1.23)	-0.99	(1.34)	-1.78	(1.51)	1.82	(1.15)
Food-processing * inter-personal / inter-unit	-1.43	(1.21)	-1.98	(1.42)	-3.56**	(1.60)	2.69**	(1.10)
Food-processing industry * competence-oriented firm strategy	-0.84	(0.94)	-0.14	(0.71)	-1.80**	(0.85)	-0.45	(0.77)
No of observations	467							
Log Likelihood	-371.710							
LR Chi-Square	463.962							
Degrees of freedom	60							
Prob > Chi-Square	0.000							
Pseudo R2 (McFadden)	0.317							
Correct classification	55.0%							
Variable Selection Method used:	Stepw ise (backw ard elimination)							
Variable removed from the MLR analysis:	INDUSTRY*PERIOD, INDUSTRY*INTLEARN							
Reference outcome	No upgrading							
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.								

Source: Own dataset, SPSS version 17.0

The industry differences in firm strategy are also present in product upgrading. Pursuing competition-oriented firm strategies increases the likelihood of product upgrading in Polish food-processing firms 6 times more than in clothing firms. In other words, pursuing competence building-oriented firm strategies as a result of the relationships the firms are involved in increases the likelihood of product upgrading in the Polish clothing firms 6 times more than in food-processing firms.

There are no significant estimates of the INDUSTRY*STRATEGY interaction variable for the outcomes managerial, process and functional upgrading. This is in line with the results of Table 8.1 where firm strategy does not differ between these two industries (Section 8.4.1). However, in the case of functional upgrading, neither the variable STRATEGY nor the interaction of STRATEGY variable with INDUSTRY variable appears to be important. This indicates that while the INDUSTRY variable by itself might have exerted a significant effect on the log odds-ratio of the functional upgrading, the firm strategy did not alter this effect.

c. Discussion and Inferences

When industry differences are controlled for, two firm internal factors are distinguished with significant effects on types of firm-level upgrading. These are the level of knowledge sharing within the firm as a complementary factor for internalisation of the externally acquired knowledge and firm strategy developed through involvement in networks (in the case of emerging market firms).

The results suggest that managerial and product upgrading are more likely in food-processing firms than clothing firms when they share externally acquired knowledge at all levels of the firm. In contrast to Szymanski *et al.* (2007: 446), who emphasized the advantages accruing to a combination of flexible, speedy decision-making structures and informal labour relations in the Polish food-processing firms, the results here show that within unit, inter-unit and inter-personal informal relations for knowledge sharing are *less* likely to contribute to managerial upgrading than formal knowledge sharing within the firm arranged by the top or middle management. This is related to the structure of the food-processing industry as compared to clothing industry. One of the differences between the two industries in Table 4.1 is that the Polish food-processing

industry is more concentrated and inclined to move towards oligopolistic structure than the clothing industry in the 1990s, especially through M&As (e.g., Yoruk 2002c). M&As introduced the foreign strategic investors to the food-processing firms, whose first attempt in the Polish firm was to re-organise existing management and introduce new managerial practices that function according to Western standards by bringing in foreign managers for specified periods of time and training managers at different levels.¹⁹⁴ These investors introduced and developed new, and brought out the existing but latent managerial capabilities within the firm that are required to translate the person embedded knowledge into firm-specific advantages. This top-down change meant most often centralisation of management among group companies, which also helped re-organisation of the management of product development. Instead of distributed efforts of every company within the group in research and product development, the new managements created synergy for product development by specialising every company in whatever it is good at (centres of competence). This change in the organisational structure of the firm brought in external knowledge from the foreign investor as a specialist and from its global networks into the firms, and put the Polish firms with foreign strategic investors in an advantageous position compared to wholly domestically-owned firms that experienced some and usually indirect access to knowledge spillovers (based on my interviews). This also explains the above discussion in the result of I/UM.1, which suggests managerial upgrading is more likely in food-processing firms whose relationships lead to learning from knowledge spillovers compared to learning by interacting.

Moreover, the division of labour among group companies not only facilitated the development of knowledge sharing mechanisms within the firms and among the group companies but also improved the opportunities for coping with the demands of the market for product differentiation and higher quality products. Although these organisational developments in the food-processing firms do not change the fact that they do not benefit directly from basic research and are not involved in in-house R&D, with the changing socio-economic patterns such as the increase in the number of working women, etc., the process innovations in the food-processing industry are

¹⁹⁴ These investors continued their M&A as a strategy for firm growth that sometimes created group companies, but sometimes the food-processing firms were sold as group dating back to the socialist times that had been led intact.

shifting from being supply-driven to market/demand-driven (Green *et al.* 1996, von Tunzelmann and Charpiot-Michaud 2000, von Tunzelmann and Yoruk 2004, von Tunzelmann and Acha 2005).

This shift directs the attention from process upgrading to the product upgrading through mostly adapting to the changing consumer demands¹⁹⁵ in alignment with the changes in process innovations (Blanchfield 1983).¹⁹⁶ Moreover, in the domestic markets, the market-seeking motives of FDI create substantial competition. These competitive forces induce increasing potential to change the balance of the domestic and foreign presence in these markets to the detriment of the former. The resulting ‘pull and push effect’ of these competitive forces created by FDI led the CEE companies to improve their capabilities in quality and standards.

Hence, competitive forces lie within the domestic market for the food-processing industry, and gaining domestic market share has become the main motive for most of the food-processing firms. Firms are required to keep up with the demand of the market through product differentiation to increase and maintain their market share and product diversification to expand their markets while meeting the needs of the market such as improvements in the product quality. With the domestic market orientation, the food-processing firms grow through domestic consumption and pushed for higher technological and business competencies by the domestic demand. Therefore, product upgrading is more likely to occur in Polish food-processing firms with competition-oriented firm strategy than in clothing firms. Hence, partly because of the new tendencies in the structure and partly because of the changing dynamics of the food-processing industry, there is an observable emphasis on the demand side opportunities, as reflected in more market-seeking than efficiency-seeking strategies in the food-processing firms.

¹⁹⁵ Like rising incomes, homogenization of tastes (demand for ethnic food); rising employment of married women (ready-made meals); increased pressure and stress in life (snacking); global competition among producers for market share restructured tastes in the world (Coca Cola, McDonald's, etc.). For example in packaging, the new processes are designed to meet consumer demands for (i) ease of use (e.g., ring-pull cans and tear-strip openings), (ii) new eating habits (as for ready meals), (iii) food-processing safety (e.g., avoiding the 'migration' of packaging into the product), (iv) environmental friendliness (e.g., avoiding non-biodegradable and wasteful packaging) (for details see Christensen *et al.*, 1996).

¹⁹⁶ For a long time in history of food industry, process innovations have been the predominant form of innovations, which mainly come from suppliers of machinery and equipment and have pushed the industry into the “supplier-dominated industry” category of the much-used Pavitt taxonomy (Pavitt 1984).

Supply side of the competition-oriented strategy for the food-processing firms is related to the uncertainty reduction with regard to the procurement of quality raw material, leading to increased quality in comparison with socialist times. Increasing their standards to the level of their competitors has been playing a significant role in their initial upgrading efforts. This has led to development of subcontracting relations within production networks. The need to develop these relations had arisen for the reason of the inability to manage input quality and quantity risk in the unstable input markets in Poland. Avoiding being exposed to uncertainties in the supply markets by developing long lasting and contract based production relationships with their farmer suppliers was a completely new type of networking activity for Polish food-processing firms. It was a result of spillovers from FDI and foreign strategic investors, because these relationships were originally initiated by a group of foreign owned food-processing firms that faced the challenge when they entered the Polish market in the early 1990s. In this way, they increased their competitiveness in the market through their own networks of production relations, particularly with upstream suppliers. Polish food-processing firms, taking MNCs operating in Poland as an example, established production networks with upstream suppliers (i.e. farmers) in order to create a secure business environment for their activities, minimise the effects of external shocks and challenges posed by the competition and increase their competitiveness against foreign firms in their domestic market.

These relations with suppliers took the form of knowledge networks due to the knowledge exchange between the actors involved, as explained in detail in section 6.3.2.2: The foreign input suppliers (e.g., animal feed producing MNC subsidiaries) cooperated with the Polish food-processing firms for experimentation and trained the agronomists of the Polish food-processing firm, and the Polish food-processing firm in turn cooperated with its domestic raw material suppliers (i.e. farmers) through their in-house agronomists to assure not only the quality of inputs for the improved production processes but also the maximum production capacity. This triangle interaction at the upstream level explains the finding regarding the higher likelihood of functional upgrading in Polish food-processing firms than in Polish clothing firms when they share externally acquired knowledge through inter-personal/ inter-unit communication within the firm.

Moreover, these developments in the Polish food-processing industry, on the one hand, allowed Polish owned food-processing firms to organise DPNs in the upstream food-processing industry. On the other hand, employing in-house agronomists brought about introduction of a new function within the firm (i.e. creation of an agronomy unit for raw material improvement via firm agronomists). It is not only an important indicator of functional upgrading in the Polish food-processing firms, but also indicates gradual increase in the quality of products leading to new product and process development within the firm and opening up of export opportunities. At the time of the interviews another motivation was to get integrated to the export markets in Europe by improving their product quality and by implementing high standards in their upstream suppliers as well as in their own production facilities. The fierce competition in the domestic market due to strong presence of FDI in the industry combined with an interest in international markets explains the finding regarding the higher likelihood of product upgrading in Polish food-processing firms than Polish clothing firms when they pursue competition-oriented strategy and confirms the changing dynamics of the food-processing industry in Poland. The results are in line with the findings of Navas-Aleman (2006) that show the importance of domestic markets for functional upgrading of the domestically-owned firms.

The interpretation of the same result from the clothing firms' perspective sheds light on the overall upgrading in the clothing industry. Being oriented, since the beginning of transition, towards export-led growth, which encourages improvements of competencies in production, clothing firms have an increasing focus on their domestic markets, where they prove to be OBMs. The changing market conditions in Poland in the early years of transition required clothing firms first to upgrade their previous practices to the modern conditions in order to cope with the increasing demand from foreign customers, and then compete with each other in the domestic market. During interviews, some Polish clothing firms declared their plans and some declared their aspirations to be OBMs in international markets.

The result that suggests product upgrading is more likely in clothing firms with competence-oriented strategy than in food-processing firms confirms their long-term

strategy aimed at competence-building for these purposes.¹⁹⁷ At the time of the interviews, there were network organiser clothing firms, who were leveraging their competences across GVCs/GPNs and DPNs by imitating the governance structure of GVCs/GPNs at home. In these DPNs one of the Polish clothing firms with an ability to leverage competences assumed the role of the lead firm of the GVCs/GPNs and organised the production of whole product range of a brand. Depending on the quality, prices and the markets targeted for the brand, the network organiser dictated the product specifications (supplier with production capabilities only used for products targeting market for low-income customers) or cooperated with the supplier firm in design activities (which are generally other brand producers used for products targeting market for high-income customers). Vistula has been the originator of this phenomenon (see Yoruk 2002a), which was followed by firms with similar managerial insight, capabilities and resources (they are also found in our sample). Some became successful, some failed. To our knowledge two such firms have merged in the late 2000s. Therefore, gradually domestic competitors came to be seen as essential actors in firm-level upgrading, used not only as benchmarks for understanding where the firm is within an industry (e.g. in the same production chain), but also as a model to catch up with and surpass, if the competitors are ahead of the company (e.g. a network organiser in the domestic market). If possible, cooperation with competitors has been also a significant vehicle to have access to the skills and competences of the competitor and to learn from them (also Yoruk 2002a).

Although food-processing firm view product upgrading as related to competition in the end-product market, the results show that Polish clothing firms view it as related to competence-building. It shows that clothing firms are approaching product upgrading as a long-term investment rather than a short-term survival activity. However, the main strategic motive behind competence building is related to improving competitiveness in the GVCs/GPNs. The relocation strategy of the lead firms in GVCs/GPNs - their being lured away by low labour cost countries - has created the main driving force for upgrading of the Polish clothing firms, which aim at providing additional skills to their customers that the low labour cost countries could not and become high quality product supplier in the GVCs/GPNs. As they passed through those stages themselves, they have

¹⁹⁷ There are also examples of entrepreneurial Polish SMEs that have focused on design and marketing, and some have even moved production to East Asia (Yoruk and Woodward, 2005).

known where the newly emerging cost cutting countries lack skills. Once they have started developing new skills that allow them to operate in different functions within the industry, they have realised the ways they can fully upgrade and play a crucial role in their environment. This is an indication of how they learned from GVCs/GPNs what lies behind becoming successful player in the fashion industry. With this long-term strategy in mind, they made their steps slowly and robustly in the early 2000s by staying within the boundaries of the domestic market instead of rushing to make investments abroad. Even so, the short-term strategy for firms like Vistula, at that time, was to move production to neighbouring countries if profitable, and start expanding markets towards neighbouring countries where they aimed at high quality end of the product markets.

As a result, networks in the clothing industry brought shifts from conventional competition for market shares or maintaining their position in GVCs/GPNs (i.e. short-term strategies for competitiveness enhancement) to diversifying their markets or positioning in networks in the future (i.e. long-term strategies for competence building) (Michalet 1991). The competition-oriented strategy of clothing firms that prioritise the firm's end-product market is still valid, but no longer sufficient. Polish clothing firms appear to understand that a firm's competitiveness does not rely only on development of its end product market but also on its organisational success in acquiring, updating and maintaining knowledge resources continuously for creative product upgrading in order to cope with the fierce increase in competition.

8.6 CONCLUSION

This chapter explored the sources of firm-level upgrading related to learning in networks. Predictive models of types of firm-level upgrading for the sample of relationships established by Polish food-processing and clothing firms, namely the Upgrading Model and an interaction model for industry differences are used for this exploration. The UM was built upon learning in networks as a two-stage process that explains the interaction between inter- and intra-organisational knowledge transfer and learning mechanisms.

As a result, the analysis in this chapter answered how learning in networks contribute to firm-level upgrading by throwing light on the impact of knowledge transfer/ acquisition

during networks through external learning mechanisms and on its combined effect with internationalisation of this, where the models tested the mediating effect of the latter on the causal relationship between external learning mechanisms and types of firm-level upgrading. The analysis in this chapter generated a number of novel findings. The results for product upgrading largely confirm the previous findings in the literature. However, process upgrading is a function of learning from advances in science and technology through knowledge networks. Strikingly, learning-by-interacting in production networks impedes not functional, but managerial, upgrading, a previously unexplored upgrading type, which is shown to be a pre-requisite for functional upgrading. While learning-by-training and research within the firm is a potent condition for external learning mechanisms to contribute to all upgrading types, for successful functional upgrading, it is a must. These findings show the importance of the adopted - integrative approach to learning in upgrading research. These findings are going to be discussed in the next chapter in relation to their implications for the upgrading literature and government policies.

Chapter 9 CONCLUSIONS

9.1 INTRODUCTION

The main argument of this thesis was built on the studies on networks as a source of knowledge and learning and on learning in these networks. It tried to answer how involvement in networks brings about firm-level upgrading by using learning in networks as a bridging concept between networks and firm-level upgrading. The definition of learning in networks in this research led to analysis at two levels. The first level answered the sub-question of how learning takes place externally through networks and represented inter-organisational level of analysis. The second level represented the intra-organisational level of analysis and answered the sub-questions of how learning in networks contributes to different types of firm-level upgrading and how firm strategy affects firm-level upgrading. These analyses were based on a dataset of relationships of Polish food-processing and clothing firms in the transition period (1989-2001). The data was gathered through in-depth face-to-face interviews during two visits in May and November 2001. For data analysis, multinomial logistic regression models are used. This chapter will present the main findings of this thesis. It will also point out its theoretical and methodological contributions, discuss policy implications and suggest new avenues for further research.

9.2 MAIN RESEARCH FINDINGS

This section recapitulates the empirical findings of this research, which was conducted at two levels of analysis based on the definition of ‘learning in networks’ in this research. Inter-organisational level of analysis investigated the knowledge acquisition and transfer in a relationship by looking at the network-related determinants of learning mechanisms external to the firm (that were later used as a reference point in the upgrading analysis), while intra-organisational level investigated the internalisation of externally acquired knowledge and firm strategy by looking at the impact of learning in networks on types of firm-level upgrading. A number of important findings have emerged from the analyses results of this research. These findings show the importance of the adopted integrative approach to learning in upgrading research.

9.2.1 Inter-organisational level of analysis: How does learning take place externally through networks?

The inter-organisational level of analysis has drawn on the view that the emerging market firms established networks to have access to external knowledge which was not available otherwise. Therefore, this thesis has first argued that firms learn externally through a variety of learning mechanisms external to the firm with intrinsic characteristics that are derived from production and knowledge networks in comparison to arm's length relations. The exploratory descriptive analysis showed that network categorisation of production versus knowledge has defined the network pattern in the industries: Knowledge networks were strongly associated with Polish food-processing firms while production networks were strongly associated with Polish clothing firms. The inter-organisational level of analysis threw light on how learning opportunities through various mechanisms were primarily shaped by the specific characteristics of networks. By analysing a number of factors that represent network characteristics with multinomial logistic regression, the elements that best characterise/define the three learning mechanisms external to the Polish food-processing and clothing firms were identified. The results of this analysis are as follows (the *ceteris paribus* assumption holding throughout):

First, the systemic origins of the networks distinguished learning from knowledge spillovers from learning from advances in S&T and education (more likely in knowledge networks and AL relations) and learning by interacting (more likely in production & distribution networks). It is not sensitive to network type, but to other characteristics of networks: It largely benefits from relationships with foreign partners, informal and continuous relations, mobility of people during the relationship and when the partner initiates the relationship. Hence, in line with the literature, continuous relationships helped developing trust and a common language between partners and allowed more spillovers and learning for Polish LMT firms (Håkansson and Johanson 1988, Simonin 1997, Inkpen 1998, Tatikonda and Stock 2003, Kim and Inkpen 2005). This result also confirmed the expected role of informal relations as positive externalities that create a strong link between networking and spillovers (Ernst and Kim 2002). However, the ability of Polish LMT firms to learn from spillovers depends largely on the partner's interest in sharing its knowledge. This finding extends Günter's (2005) findings on cooperation as a spillover channel, as the spillover effect is strong

only when the partner initiates the relationship. Moreover, a relationship with a foreign partner is more likely to spill over knowledge than a domestic partner. This is in line with the literature on FDI in CEECs that suggests foreign firms lead to knowledge spillovers, considering little possibility for spillovers from domestic partners due to deficiencies in their knowledge base (Chapter 5). In addition, it supports Ernst's (1997) *knowledge spillover effects* as one of the indirect forms of knowledge diffusion within the subcontracting relations of Polish firms with foreign firms in GPNs (as mentioned in section 2.5 in Chapter 2). It also corroborates a shift from domestic to foreign sources in Poland's knowledge and production systems, leading to a new type of failure, namely 'network failure' as the weakness of the NIS in Poland (chapter 5), where the dearth of the local and international networks of socialist period was replaced with exceptionally powerful global networks (both through FDI and GPNs) which are not in alignment with the local and the weakened national networks (von Tunzelmann 2004, 2010).

Second, in terms of characteristics of knowledge transfer during the relationship, the most notable result is a very strong effect of mobility of skilled people on learning mechanisms external to the firm. Mobility of skilled people is a significant component of knowledge transfer during a relationship and is positively associated with the likelihood of all three learning mechanisms external to the firm. This result is in line with the literature which suggests knowledge transfer through mobility of people is what is behind the success of reverse-engineering in developing countries (Kim 1998, 2001), the spread of knowledge spillovers between foreign and domestic firms (Mowery and Oxley 1995, Günter 2005), the development of export-oriented production by means of GVCs/GPNs (Ernst 1997, , Schmitz and Knorringer 2000, Saliola and Zanfei 2009), and improvements of the firm's product development capabilities after technology purchase accompanied by mobility of engineers (Teece 1977) among many other effects. Therefore, this result extends our understanding of 'mobility of people' as an important spillover channel during any type of relationship.

Third, one-off relations provided more access to new advances in S&T. As expected in the emerging market context, learning from advances in S&T is also more likely when the knowledge is transferred uni-directionally rather than bi-directionally, which indicates the lack of joint knowledge sharing and generation during the relationships. Apparently, the relationships with technology developers and suppliers are not built on

mutual interaction that has continuity. The knowledge comes uni-directionally within a relationship that lasts for a specific duration relevant /enough for the technology transferred. Learning from advances in S&T and education is more likely to occur for firms that seek for technology-related (new production processes, machinery and equipment, etc.) as well as business & quality management-related knowledge (partly ICT, partly ISO management) in their relationships. These findings would seem to indicate that Polish LMT firms are users of the knowledge generated (e.g. in technology acquisition projects, contract research with universities, etc., all of which indicates supplier-dominated nature of LMT industries as defined by Pavitt (1984)) instead of participants in generating it. Under the emerging market circumstances of these firms, it may not be plausible to expect high levels of appropriability of new technologies from LMT firms. But, as the intra-organisational level of analysis finds below, when the impact of external and internal learning mechanisms on firm-level upgrading is investigated together, this is not the case. An indication of this is not being the case is in the fact that the firm initiates the relationship. The fact that the firm initiates the relationship, shows that the Polish LMT firms are actively interested in finding out and learning from new advances in S&T and are willing to learn as much as possible during technology acquisition processes. The implications of this willingness to learn new technologies do not generally lie in the appropriability of technologies but definitely in the prospects for product development with the use of new advanced knowledge and technologies. In addition, this type of learning appears to be significant for food-processing firms (medium-tech) relative to clothing firms (low-tech), indicating the greater technological orientation of food-processing industry compared to clothing industry.

Fourth, learning by interacting is more likely in relationships with foreign partners who bring in market-related knowledge to the Polish LMT firms. This finding supports the upgrading literature suggestion that learning opportunities for domestic firms particularly in buyer-driven GVCs with foreign buyers. It also suggests the transfer of market-related knowledge during relationships with suppliers, customers, users and complementary firms in the industry, - all sources of insightful feedback and market knowledge. Empirically, all these characteristics of learning by interacting have been observed by Dyker *et al.* (2003) in the experiences of a domestically-owned Slovenian firm. Moreover, this result is compatible with use of experience of people on the

frontline such as sales personnel's relationships with the other market actors (wholesalers, retailers, etc.), as suggested by Johanson and Vahlne (1977) in gradual market entry in the context of foreign investments.

Fifth, the inter-organisational level of analysis also found differences between industries with regard to the network type, formality and continuity of the relationship and the mobility of people during the relationship. As expected, Polish clothing firms appeared to learn from knowledge spillovers in production and distribution networks (the dominant network type for these firms) *more* than Polish food-processing firms. Moreover, compared to food-processing firms, they also benefited from spillovers in occasional relations rather than one-off relations and made use of mobility of people during relationships to learn from advances in S&T (such as technicians of the global buyer or technology supplier). In contrast to Polish food-processing firms, in the mid-1990s, they intensified their learning by interacting (in production networks and value chains) compared to early 1990s - a time period that coincides with the emergence of DPNs.

Polish food-processing firms, however, are more likely to learn by interacting and from knowledge spillovers through AL relations, when compared to clothing firms. Moreover, they are more likely to learn from advances in S&T and education through informal relationships. This result has two implications. First, it underlines an exception to the abovementioned 'network failure' (von Tunzelmann 2004, 2010) observed in the food-processing industry. These relations of food-processing firms indicate that old informal networking still survives (with the universities and research institutes), although it is hard to expect these relations to create a basis for development of a strong sectoral systems of innovation. A new type of informal relations with foreign sources of knowledge is emerging in the food-processing industry through linkages with foreign strategic investors and their linkages. Second, it supports the above finding on the greater technological orientation of food-processing firms than clothing firms. Instead of reliance on formal technology transfer purchases, developing informal relations indicates that food-processing firms are more interested in the outcomes of basic and applied science (based on my fieldwork, most of the informal links of food-processing firms were with universities that the engineers had graduated from) and the appropriability of these new knowledge and technologies than clothing industries.

Technological dependence on technology suppliers is more strictly observed in the clothing firms, as they tend to learn from advances in S&T when there is someone (an expert) exchanging and demonstrating knowledge strictly face-to-face. This result strikingly indicates that S&T knowledge is more tacit in clothing industry, I suspect particularly in relation to design-related production processes (such as prototyping, using CAD, etc.) and specialised machines (such as new style button-holing, hand-made effect sewing etc.). To exemplify, a food-processing firm that has never produced feta cheese before can take examples available in the market and learn producing it with trial and errors on its existing production technologies by means of cooperation between a group of production engineers and marketing people (e.g. Mlekovita in Poland, Napolact in Romania). But a clothing firm cannot imitate a piece of clothing that has been designed to look like hand-made without the specialised machinery and the experts that must train the employees who are going to use this machinery. This example highlights how the need for mobility of people in learning S&T knowledge in clothing firms might be due to lower skills of employees in comparison to those in food-processing firms, another reason for greater technological orientation of food-processing industry compared to clothing industry.

9.2.2 Intra-organisational level of analysis

The interaction between inter- and intra-organisational analysis of the relationship between networks and firm-level upgrading is an essential part of this research. The inter-organisational level of analysis is carried into intra-organisational level of analysis by means of the variable ‘learning mechanisms external to the firm’ which was a dependent variable in the former analysis. The intra-organisational level of analysis was conducted in four models. The first two models examined the contribution of learning in networks to types of firm-level upgrading. The third model examined the additional effect of firm strategy on types of firm-level upgrading. The results of the interaction model are discussed as an extension to the results of these models.

9.2.2.1 How does learning in networks contribute to different types of firm-level upgrading?

a. Learning mechanisms external to the firm

The intra-organisational level of analysis first identified the impact of learning mechanisms external to the firm on types of firm-level upgrading. Most importantly, the

results showed that learning by interacting impedes managerial upgrading. This meant production and distribution networks with foreign partners and market-related knowledge through consulting firms, etc. were *less* likely to contribute to managerial upgrading in Polish LMT firms. This result substantiated the earlier findings in the upgrading literature that global buyers do not want their suppliers to encroach on their competences (Schmitz 2006). This view is strongly based on governance issues in GVCs/GPNs. However, the results of the interaction model that was crafted to advance our understanding of the role of learning mechanisms external to the firm on upgrading types with respect to industry differences indicate that managerial upgrading is more likely in Polish food-processing firms than in Polish clothing firms when their relationships lead to learning from knowledge spillovers rather than learning by interacting or no learning. In the context of food-processing firms, this result indicated the positive influence of foreign strategic investors on managerial upgrading of privatised food-processing firms.

In addition, other results of this analysis include: Process upgrading was more likely to happen through learning from advances in S&T while functional upgrading was more likely to happen through learning by interacting. All three learning mechanisms external to the firm had positive effects on product upgrading.

b. Internalisation of externally acquired knowledge

Intra-organisational level of analysis then examined the mediating effects of internal factors between learning mechanisms external to the firm and types of firm-level upgrading. These internal factors were learning mechanisms internal to the firm and level of knowledge sharing within the firm. The results indicated that learning mechanisms internal to the firm became the sole mediator; more precisely, learning by training and research became a strong condition for all learning mechanisms external to the firm to effectively contribute to upgrading within the Polish LMT firms. In other words, the analysis of mediating effects of the internal factors found that Polish LMT firms take on the responsibility for upgrading their capabilities through learning by training and research. Other things being equal, these internal learning mechanisms have significant positive effect on all four types of firm-level upgrading.

This result extends our understanding of the level of absorptive capacity of Polish LMT firms. Combined with a dynamic analysis of upgrading, this finding means the firms' absorptive capacity was increasing over time for managerial and functional upgrading. Despite a gradual increase in the late 1990s relative to mid-1990s, the absorptive capacity of Polish LMT firms needed for internalisation of externally acquired knowledge for an increase in the likelihood of process upgrading was highest in the early 1990s. Second, this result also shows the importance of examining learning in networks as a two-stage process. In the case of association between process upgrading and learning from advances in S&T and education, examining only the learning mechanisms external to the firm would seem to indicate the abovementioned supplier-dominated nature of Polish LMT firms. However, when internal factors were controlled for, this association is mediated by intensive sharing of externally acquired knowledge within the unit and between people and among units as well as gradually increasing levels of absorptive capacity over the years that allowed re-configurations or modifications of the new technology for domestic applications. Hence, as mentioned above, this result implies that the LMT firm cannot simply be labelled as a 'user' of the technology purchased, of the outcome of the research project in which it participates, and so on.

Another important result is the perfect mediation of learning by training and research between learning mechanisms external to the firm and functional upgrading. This means that learning by interacting and learning from knowledge spillovers during the relationships contribute to the likelihood of functional upgrading because of the strong and effective presence of learning by training and research within the firm. This result implies that functional upgrading is essentially an internally-driven upgrading type, which requires the firm to be an active learner, to be aware of the need to combine externally acquired knowledge with internal resources and capabilities and to display high levels of absorptive capacity within the firm for internalisation of the externally acquired knowledge. The findings also suggest that the latter can happen only when managerial upgrading precedes functional upgrading. Empirical studies in the upgrading literature to date provided controversial evidence as to whether being inserted in GVCs/GPNs facilitates functional upgrading or not. This finding provides a reasonable answer to this controversy. It shows that regardless of which systems knowledge comes from (i.e. production, knowledge or market), unless it is internalised through active

internal learning mechanisms with high absorptive capacity, the likelihood of functional upgrading is low. Most importantly, as opposed to GVC perspective to upgrading, it showed that learning by exporting and learning by doing have no statistically significant effect on functional upgrading.

The results found that learning by doing is more likely to contribute to product upgrading, and no other types of upgrading. Moreover, the effect of learning by interacting on product upgrading disappears when internal learning mechanisms are controlled for. The argument that GVCs/GPNs lead to firm-level upgrading through learning by doing is contradicted by this result. Instead, it appears that learning from spillovers and learning from advances in S&T are more likely to contribute to product upgrading within Polish LMT firms, particularly when learning by doing and learning by training and research act as potent conditions for the external learning mechanisms. Especially, higher likelihood of product upgrading when there are learning from spillovers and learning by doing/imitating /failing substantiates demonstration, observation, and imitation as the spillover channels (Mowery and Oxley 1995, Ernst and Kim 2002, Günter 2005).

In addition to learning by interacting, learning from knowledge spillovers is less likely to contribute to managerial upgrading. Moreover, managerial upgrading is more likely when knowledge is shared at all levels of the firm, indicating a top-down approach to management. This result, on the one hand, is supportive of negative knowledge spillover effects in Polish LMT industries, though only with regard to managerial upgrading, when compared to high-tech industries (Weresa 2004). On the other hand, when industry differences were controlled for, the results indicate that this does not hold for food-processing firms. In contrast to Jensen's (2004) findings, food-processing firms are more likely to achieve managerial upgrading through knowledge spillovers from foreign partners (in this research, foreign strategic investors and MNC subsidiaries in Poland). Moreover, this finding suggests that, although there are learning effects from knowledge spillovers from global buyers in GVCs / GPNs to the Polish clothing firms (section 7.5.2.3), this effect does not contribute to managerial upgrading in these firms (though it does to product upgrading). As a result, while global buyers in production networks and value chains (in the form of spillovers and interacting) create an obstacle

to managerial upgrading of Polish clothing firm, foreign strategic investors in food-processing firms facilitate it.

The significant and positive effect of the levels of sharing externally acquired knowledge on the likelihood of process upgrading provides strong evidence for spiral of organisational knowledge internalisation (cf. Nonaka 1994) starting with the unit, and then between people and among units after external knowledge is acquired during the relationships. This happens only in process upgrading and applies to both industries (as this effect disappears when industry differences are controlled for). However, the sharing of externally acquired knowledge at all levels of the firm is more likely to contribute to managerial upgrading, and this effect is particularly significant for Polish food-processing firms. The results of the interaction model of upgrading confirm this result also for product upgrading. Oligopolistic structure of the Polish food-processing industry in the 1990s as compared to clothing industry brought in the introduction of foreign strategic investors. As the direction of competition in the industry moved to product differentiation and higher product quality, the industry shifted from being supply-driven to market/demand-driven. There have been attempts to increase product quality by the development of production networks in the upstream segment of the industry with farmers. This development is supported by establishing agronomy units within the firm that experiment, train the farmers, and get trained by firms in the upstream networks (e.g., MNC agri-business subsidiaries). The sharing of such externally acquired knowledge at inter-personal / inter-unit levels within the firm increased the likelihood of functional upgrading in the Polish food-processing firms.

Finally, the results of inter-organisational level of analysis do not support tracing changes in learning mechanisms external to the firm over time, but the results of intra-organisational level of analysis allow us to observe evolution of an upgrading pattern in Polish LMT firms over time. The latter finding (as the result of the interaction between inter- and intra-organisational knowledge transfer and learning) not only provides strong evidence that knowledge acquired from relationships internalised and accumulated within the firm over time changes the likelihood of specific types of firm-level upgrading, but also allows us to observe a time pattern in the impact of learning in networks on upgrading within the firm. This pattern supports and extends the findings

of earlier case studies on firm-level upgrading in other emerging markets in the world (Schmitz 2006).

Similar to earlier studies, our evidence show that the upgrading pattern of Polish LMT firms during transition years was not divorced from global developments in the organisation of their respective industries. They followed an upgrading pattern of focusing first on process upgrading through international technology acquisition and knowledge networks, which was a good indicator of successful catching-up (von Tunzelmann 1995). It is likely that in the future, this would make them more (inter)dependent rather than independent in their upgrading. However, earlier studies view GVCs/GPNs as a fast track to product and process upgrading (Schmitz 2006). In contrast, in the case of Polish LMT firms, this research has found that product upgrading happened throughout the transition years and is a constant part of an upgrading pattern. In other words, firms need to sustain their competitiveness all the time, and for LMT firms, the easiest way to do so is to keep upgrading their products. Moreover, this research shows for the first time that, in the later years of transition, new patterns of upgrading started to emerge. First managerial upgrading (particularly in the context of transition) appeared as a pre-requisite to functional upgrading. Then, functional upgrading came as a result of the cumulative effect of external knowledge acquisition *and* its effective internalisation within the firm.

9.2.2.2 How does firm strategy affect firm-level upgrading?

In addition to the analysis of mediating internal factors, intra-organisational level of analysis looked at the role of network involvement in gaining a new perspective on strategy development in emerging market firms. The approach to firm strategies in the upgrading literature (GVC perspective), which stresses keeping up with the competition as the driving force for firm-level upgrading, is supplemented with resource-based view of the firm in this research. Hence, this research compared the orientations of firm strategies towards competitiveness enhancement with competence-building and leveraging. The results of this analysis have shown that Polish LMT firms became aware of the fact that without competence-building for managerial, process and product upgrading, it is hard to enhance competitiveness in the supply and end/product markets. Therefore, the results for strategy orientation highlight that Polish LMT firms are not necessarily stuck with their initial survival motives for establishing relationships and

managed to gain new perspectives by means of their relationships. This helped them develop a vision for securing their future in the changing circumstances of their industry. Moreover, the results also show that firm strategic orientation differs among Polish LMT industries, particularly in product upgrading. The relationships Polish clothing firms were involved in orient their strategies towards competence-building for product upgrading. However, structural changes in the food-processing industry from supply-driven to market/demand-driven, combined with the importance of high input quality for product upgrading, oriented Polish food-processing firms strategically to focus on reducing uncertainties in their supply markets and increasing their competitiveness through differentiating their products with higher product quality. This difference not only emanates from the structure of the industry and dominant relations, priorities in their markets, the market they operate and the targeted market, and so on (section 8.5.4.2). It is also seen in the result that the impact of learning in both production and knowledge networks on product upgrading to which all three external learning mechanisms contributed (section 8.5.1) is greater for clothing firms than for food-processing firms (i.e. compared to food-processing firms, in the clothing firms, production networks are more likely to lead to learning from spillovers, and mobility of people is more likely to lead to learning from advances in S&T which is embedded in knowledge networks; see section 7.5.2.2).

9.3 THE CONTRIBUTIONS OF THIS THESIS

This thesis has investigated how involving in networks brings about firm-level upgrading. It represents an attempt to broaden the upgrading literature's exclusive focus on value chains and production networks by exploring the roles of other network types as well as the variety of learning mechanisms that take place in these networks and learning processes within the firm. By pulling together the concepts and insights from different theoretical backgrounds on upgrading, learning and networks, this thesis contributes to the theoretical and empirical advancement of our understanding of the relationship between learning in networks and firm-level upgrading. This section also point out to the implications of this research for the upgrading literature.

9.3.1 Theoretical contributions

9.3.1.1 Production and knowledge systems: The need for alignment of networks

Existing studies on upgrading have focussed on the role of networks embedded in production systems and attempted to explain them as the major, or even the only, external source of upgrading possibilities within the firm. Was it really only production systems that created opportunities for upgrading in emerging market firms, or has the research intentionally restricted the concept to production systems based on an expectation that changes in the organisation of industries would create the necessary environment for domestic firms to upgrade through easy access to knowledge via exporting for foreign customers?

The answer to this question in the upgrading literature from the GVC perspective is based on an assumption that being inserted in global value chains naturally leads to upgrading within the firm, though recent upgrading studies have started challenging this view, which is a result of the emphasis on the governance in the GVCs. The answer to the same question from the GPN perspective (which also examines GPNs largely through the lens of governance issue) is based on the acknowledgment of the importance of knowledge diffusion and sharing in GPNs. Empirical evidence is focused on industries in which such international organisation of production has been observed, and the contribution of knowledge systems in any industry is largely ignored (Bell and Albu 1999).

This thesis argues that these studies of upgrading have overlooked learning opportunities for upgrading by narrowing the latter to interactions with the global buyers within GVCs/GPNs, as if knowledge comes only from them. However, in the real world, there are varieties of networks ranging from geographical networks (including national and local ones in addition to international ones) to networks that provide the firm with resources and knowledge (such as links with universities that provide the firm with research personnel and technology, with business schools that provide managerial personnel, and R&D institutes and technology suppliers that provide R&D capital and technology; see von Tunzelmann 2004). There are also functional networks that are related to firm functions other than production, including technology, products, marketing, finance and management (von Tunzelmann 1995, also in relation to Figure 2.2 in section 2.3, p. 42). Firms use and somehow align all these various types of networks for their production; in other words, value chains in emerging

market countries are more complex than their portraits in the upgrading literature (von Tunzelmann 2004).

This thesis contributed to expanding our understanding of how networks embedded in systems available in the wider economy can be fruitfully combined with GVC/GPN perspectives in order to explain the upgrading of the firm. To do so, this research employed *a wider perspective to networks* as one of the sources of firm-level upgrading. It empirically brought the two perspectives on production networks (GPNs and GVCs) together and added an evolutionary perspective by including networks that originate from knowledge systems, i.e. knowledge networks. To my best knowledge, this research is the first to examine firm-level upgrading with a comprehensive approach to networks in systematic way.

The findings signalled a re-alignment of networks with the shift from knowledge networks with domestic partners to production networks with foreign partners. As is well known, in the socialist period, hierarchical national networks were dominant for resource flows (with centrally set targets for national output and technology and dictating the scale and scope of operations). Firm functions were limited to production, global networks were weak, and international resource flows were largely limited to the CMEA markets. The findings of this research for the transition period showed that learning from knowledge spillovers and learning by interacting (mainly within GVCs/GPNs) happen in relationships with foreign partners. This result has further established the role of foreign partners in global networks in the upgrading of emerging market firms. In the context of Polish food-processing and clothing firms during transition years, there is a clear penetration of foreign actors through GPNs/GVCs or as FDI, while national and local networks seem to be replaced with international / global networks. This can be taken as the presence of network *misalignment*, characterised by the disappearance of the old networking system of socialist era (von Tunzelmann 2004).

However, the results of this research also indicate a new development in the production systems at the national level, namely domestic production networks (DPNs), emerging after the mid-1990s (see section 6.3.2). This may be taken as a new form of network *realignment* indicating the emergence of a new national system of production - replacing the old networking system of the socialist era - as a result of learning in

GVCs/GPNs or from FDI. Unfortunately, there is little evidence for successful alignment of resource and functional networks with this emerging and encouraging development in the geographical networks in the production systems. In other words, knowledge systems at the national and local levels are not supplementing production systems.

It is also clear from the results of this research that when one of the geographical networks dominates (GVCs/GPNs and FDI), particularly in the emerging market context, learning from foreign partners leads only to partial firm-level upgrading (i.e. process and product upgrading based on imitation). Moreover, the results showed that while foreign partners might restrict the managerial upgrading opportunities of firms, only firms that successfully internalise the externally acquired knowledge achieve functional upgrading. Successful firm-level upgrading requires significant support from strong knowledge systems (e.g., national innovation systems) where the resource and functional networks at different geographical levels are aligned with each other and, as a result, support internal and external learning processes and develop absorptive capacity within the firm for self-sustaining growth.

By empirically examining all these networks available in the wider economy, the findings of this research lead to a discussion about the alignment of networks (von Tunzelmann 2004, 2010), drawing our attention to its importance in attaining successful upgrading at all levels (i.e. firm, industry and country) in the emerging markets, and suggest that we look for the means for network alignment that prevents one-sided network development in the emerging market economies (i.e. dependency on global networks). This is a field where more empirical research is needed; however, this thesis has contributed by providing initial indicators for the changing nature of networks and bringing attention to their potential future evolution as well as the positioning of the firms with regard to their capability development and upgrading in all this development.

9.3.1.2 Learning in networks as a two-stage process

The upgrading literature assumes that learning in production systems happens only through ‘learning-by-exporting’ and ‘learning-by-doing’, while value chains are seen as a natural source of learning and upgrading for emerging market firms. However, this

has not been backed with sufficient empirical work. None of the case studies presents an in-depth examination of the role of learning-by-doing in firm-level upgrading, but simply observes, without elaboration, that suppliers learn from their buyers by fulfilling the specifications requested by the buyers (Schmitz 2006). The few studies that have attempted to look at firm-level process and product upgrading in relation to ties with organisations outside of GVCs/GPNs also assume that learning took place in these relationships naturally (McDermott and Corredoira 2010).

The upgrading literature further emphasises that global buyers do not allow their suppliers in emerging markets to encroach on their core competences. These suppliers are seen as either being locked into GVCs/GPNs because of financial difficulties (due to the enormous costs such market expansion incurs; see, for example, Navas-Aleman's (2006) analysis of Brazilian footwear and furniture industries) or unable to acquire and develop the required capabilities for functional upgrading through GVCs/GPNs (not necessarily design capabilities but management of marketing and branding strategies; see Özatağan 2010). By addressing each of these limitations, this thesis draws on GVC and GPN perspectives to upgrading with a special interest in the *knowledge flow processes* during these relationships.

Building on the earlier work in the upgrading literature (mostly knowledge diffusion and sharing in the GPN approach) and motivated by the learning literature that highlights the 'reverse learning trajectory' in developing country firms as well as their 'absorptive capacity', this thesis used a two-stage process of 'learning in networks' as a bridging concept between networks and firm-level upgrading to understand the role of knowledge flows (i.e. combining knowledge acquisition from networks and internalisation of this external knowledge). This research has argued that without complementary internal factors (i.e. learning mechanisms internal to the firm and knowledge sharing levels within the firm), external learning from networks have little chance to turn into upgrading. To my best knowledge, this thesis is the first research to examine firm level upgrading with an integrative approach to learning in networks in a systematic way.

Neither intra-organisational learning nor the interaction between inter- and intra-organisational knowledge transfer and learning has received the kind of attention it

deserves from those researching upgrading. Networks only allow firms to gain *access* to the ideas, resources, skills, knowledge and technology (hereinafter, knowledge for short) of their partners. The term ‘external learning’ is used here to refer to learning when the firm develops the ability to *identify* and *acquire* new, potentially useful and invaluable knowledge *while in a relationship*. It is about whether the firm has a “learning capability”, a requirement for absorptive capacity (Kim 1999a, see section 2.3.2, p. 54), and, in the context of this research, during a relationship with an external agent. However, this definition of external learning does not necessarily include assimilation of this knowledge within the firm. For instance, a knowledge worker can identify and acquire new knowledge informally from the technician of a partner firm during a critical operation. If he does not share it with the firm’s other employees and apply, adopt or adapt this knowledge within the relevant segments/operations of the firm, then this externally acquired knowledge will not be assimilated, perhaps wasting an opportunity to enhance competences within the firm. In other words, the external learning will not be fully realised. Hence, in this research, the term ‘internalisation of externally acquired knowledge’ is offered as an integrative part of, and a *complementary* process to, external learning and is used here to refer to adoption and adaption of the knowledge of the partner by applying it to establish, operate, improve or expand the capabilities of the firm. The complementary nature of external learning and internalisation of externally acquired knowledge is often overlooked. This research focused on this complementarity between *subsequent* external and internal learning and aimed to show how the upgrading opportunities for the emerging market supplier firms are affected when both learning processes complement each other as opposed to external learning without successful internalisation. It showed that once the externally acquired knowledge is internalised, the firm has more opportunities to upgrade its products, processes, managerial or other functions and apply them to other geographical markets, new businesses, and so on.

In this research, internalisation of externally acquired knowledge is examined in the context of networking relations, i.e. it does not refer to the creation of knowledge by internal sources of the firm (e.g., by the firm’s own in-house R&D per se) or the internalisation of the knowledge embodied in, for instance, a patented product of another firm that is publicly available in the market and that the firm researchers can easily access, examine, reverse-engineer and imitate. It only refers to the assimilation of

external knowledge that comes through being engaged in a relationship within a network. This is where this term differs from ‘absorptive capacity’; originally building on absorptive capacity, internalisation of externally acquired knowledge from networks represents only a subset of a firm’s absorptive capacity – in other words, absorptive capacity in the context of learning in networks.

Because the term is defined in relation to networks, its operationalization has differed from that of absorptive capacity in the literature, which is composed of prior knowledge stock of the firm and intensity of effort (Cohen and Levinthal 1990, Kim 1999a, Zahra and George 2002). In order to stress the importance of complementarity between external learning and its internalisation, internalisation of externally acquired knowledge is operationalised through a) knowledge sharing mechanisms at different levels of the firm, and b) Malerba’s (1992) ‘internal learning mechanisms’, with both adapted to the sequential learning within networks. With this operationalisation, although prior knowledge stock of the firm is not represented, the intensity of effort component of absorptive capacity has been captured in one of the active internal learning mechanisms, namely ‘learning by training and research’ (research in the sense of Kim 1998a; see section 3.4.2, p. 79).

As the results of this thesis showed, this variable in particular has proved to have an influential role in mediating between external learning and firm-level upgrading (i.e. learning by training and research appears to be a strong condition for external learning mechanisms to affect all types of upgrading, except process upgrading). It also allowed us to shed light on underdeveloped issues (such as managerial upgrading) and unanswered questions (such as why emerging market firms cannot upgrade functionally) in the upgrading literature by highlighting the significance of the firm’s absorptive capacity for firm-level upgrading as a result of being involved in GVCs/GPNs. By and large, examining learning in networks as a two-stage process significantly improves our understanding of what lies behind firm-level upgrading; in other words, how critical it is to support the crucial role networks play in firm upgrading by the firm’s subsequent internal efforts to develop new capabilities.

9.3.1.3 A new concept in the upgrading literature: Managerial upgrading

One such area of capabilities that the emerging market firms need to develop consists in the managerial capabilities and related capabilities for strategy development. Both in theory and in practice, the internalisation of externally acquired knowledge is strongly related to these capabilities, as examined in the resource-based view of the firm (Penrose 1959). The empirical tools that have been developed within the upgrading literature so far tend to overlook the importance of organisation and management features embedded in the internal dynamics of the firm and to categorise them under functional upgrading, which are by no means the same. This research contributed to the literature by defining, integrating and examining ‘managerial upgrading’, which plays a significant role in firm-level upgrading, particularly in the context of emerging markets. Not only has it been driven more by internal incentives and effort of the firm than by external stimulation through knowledge spillovers and learning in GVCs/GPNs, but it also has appeared to be a pre-requisite for functional upgrading, which, as this research showed, requires accumulation of knowledge and capabilities specific for it. This thesis has also illustrated the emerging market firms’ awareness of, and focus on, developing strategies for competence-building in the transition years to leverage improving their competitiveness in the end-product markets in the long-term. This significant finding indicates that these firms do not prefer short-term solutions to gain competitiveness in their product market in lieu of achieving functional upgrading in the long-term.

The findings on the link between managerial and functional upgrading and on the importance of competence-enhancing strategies for long-term competitiveness as backdrop for successful firm-level upgrading are so novel that they are expected to open up new discussions and help improve our understanding of the *dynamics* behind the unanswered questions in the upgrading literature.

9.3.1.4 Dynamic analysis of firm-level upgrading

Finally, another contribution of this thesis is to look at the impact of networks on firm-level upgrading over a certain time period rather than at a point in time. The research methods used to analyse upgrading (i.e. case studies) have so far not provided a systematic analysis of upgrading patterns over time. Schmitz (2006) calls for research that captures changes over time in order to elucidate the distinction between the learning effects in GVCs/GPNs in early and advanced stages. To fill this gap, Schmitz

(2006) attempts to bring together the findings of the qualitative case material conducted in the Brazilian footwear industry in early 1990s (Schmitz 1995), in mid-1990s (Schmitz and Knorringer 2000) and late 1990s (Bazan and Navas-Aleman 2004). The dynamic analysis in this thesis that compares the early 1990s with the mid- and late 1990s allowed us to observe the nature, the evolution and the impact of networks established during twelve years of transition on the upgrading pattern at the firm level through changes in the firms' level of absorptive capacity.

Consequently, the findings of this research put recent debates on the role of networks in the upgrading of emerging market firms into a somewhat wider perspective by employing networks embedded in a variety of systems available in the economy and by developing the neglected argument about the *complementary* learning processes in networks that involve issues such as firm absorptive capacity, managerial capabilities and strategy development. Should future research on upgrading through networks build on these novel findings, in practice it would help the emerging market firms to gain insights into their learning potential in their networks, and to develop appropriate strategies for effectively benefitting from their networking activities, efficiently using their resources within the firm and enhancing their capabilities to upgrade. In theory, these findings are a testimony for the need to employ an inter-disciplinary approach to GVCs/GPNs and upgrading in general if we are to understand the underlying reasons and to illuminate the links between external and internal phenomena.

9.3.2 Methodological contributions

Empirically, this research does not follow the tradition of upgrading literature, i.e. extensive and detailed case studies. Instead, it constitutes a detailed, empirical attempt to provide statistical evidence that has typically been lacking in the research on learning and upgrading. It is acknowledged that concepts like networks and firm-level upgrading encompass qualitative elements that need to be explored through in-depth empirical research; e.g., trade and investment statistics are of no use (Schmitz 2006, Sturgeon 2008). However, the ability to generalise is only possible through a larger dataset, which involves analysis with statistical methods. This research employed a mixed approach of the two to the analysis of networking for upgrading: The research design of this study was built on the collection of primary data via face-to-face semi-structured interviews, which was preceded by a questionnaire survey as pilot work, that

is transformed into a dataset for analysis. Hence, this study for the first time provides a methodical transformation of qualitative discussion of upgrading based on case studies into an enhanced quantitative analysis that systematically assesses the contribution made to firm-level upgrading by networks and learning that takes place in them.

Existing studies in upgrading attempt to explain industrial upgrading based on a firm-centred approach. Firm is the relevant unit of analysis in case study methods. However, the whole discussion in these case studies revolves around how ‘relationships’ with global buyers in GVCs/GPNs lead to upgrading within the firm. To my knowledge, the only quantitative analysis of process and product upgrading in Argentine auto parts industry is also using the firm as the unit of analysis and investigate the impact of number of relationships on these types of upgrading; in other words, *whether* linkages with customers affect product upgrading and *to what extent* (McDermott and Corredoirra 2010). Such an analysis confirms and complements the results of existing case studies, which merely focus on questions, such as ‘whether’ GVCs/GPNs are a facilitator or barrier to domestic firm’s upgrading, ‘whether’ GVCs/GPNs or domestic networks lead to upgrading, and ‘what type of governance’ affect ‘what type of upgrading’.

To start with, this research took all the case studies done so far as the evidence for the positive impact of relationships on firm-level upgrading. To improve our understanding of the dynamics of firm-level upgrading, opening the black-box of ‘how’ upgrading within the firm happens through involving in networks was needed and it required a new approach to the analysis of upgrading. Putting the emerging market firm at the core of all the relations embedded in systems surrounding it (as in Figure 2.2), this research is distinguished from those studies by emphasizing a new unit of analysis: the relationships of the firm. Using this unit of analysis, this research contributes to the upgrading literature by its ability to examine *how* these relationships lead to upgrading within the firm: what characteristics of the relationships create valuable learning, and how learning in networks affects firm-level upgrading.

As a result, the strength and the originality of the analysis in this research lie in the in-depth nature of the investigation of each relationship of the firm. This way, neither were the details of case study methods lost nor was the generalizability of statistical methods given up.

9.3.3 Implications for the Upgrading Literature

This thesis has a number of implications for both theory and practice in the upgrading literature. Using a sample of large clothing and food-processing firms that were operating in multiple value chains, presenting relatively high level of competence and low risk of failure as suppliers and integrated into knowledge networks in international and domestic markets (as well as production networks), this thesis made a contribution to underdeveloped issues in the upgrading literature by using ‘learning in networks’ as an empirical tool to explain the dynamics of the relationship between networks and firm-level upgrading.

This research has contributed to solving the controversy over functional upgrading. The two-stage analysis of learning in networks filled the gap with regard to why some firms successfully achieve functional upgrading while others fail by showing the importance of internalisation of externally acquired knowledge. Our results suggest that getting knowledge about how to manage (e.g., in marketing) during a relationship cannot be taken as a major contributing factor to functional upgrading. Passive learning mechanisms such as learning by doing are also not the recipe for it. A high intensity of effort is required from the firm to actively internalise this knowledge in marketing through for instance establishing a marketing department with specialised employees, training sales personnel, developing a feedback system through wholesalers, retailers, distributors, searching to gather information about the market, and so on. This means that firms may get involved in value chains and other types of relationships where there is wide array of opportunities to learn and acquire skills and capabilities that are new to the firm and may still have difficulties to turn them into new functions, more precisely competences, unless they put effort into it to develop the ability to internalise this external knowledge particularly through using its own human resources (i.e. intangible assets, not investments in tangible assets), through training and research within the firm.

Differences between firms’ ability to upgrade functionally can, to a great extent, be found in the differences in the managerial ability of each firm to organise all these activities (Penrose 1959). Hence, the findings of this dynamic analysis of firm-level upgrading show that managerial upgrading is indeed a pre-requisite for successful

functional upgrading. Although functional upgrading strongly depends on how successfully a firm upgrades managerially, the results indicate that it requires internal incentives for developing strong absorptive capacity within the firm through training and research. So, making use of the resource-based view of the firm, this finding shed significant light on the controversy on the functional upgrading in the literature.

Managerial upgrading is either forgotten or taken as given in the GVC perspective to upgrading literature which focuses on the lack of global buyer's support for the functional upgrading of their suppliers (Schmitz 2006, Gibbon 2008, Navas-Aleman 2011). The results of this research show that it is managerial upgrading, not functional upgrading, where global buyers do not support, and may become an obstacle to, their suppliers (section 8.5.1.3). Distinguishing between functional and managerial upgrading brings in a new dimension to the discussions in the upgrading literature that requires directing our attention from industrial organisation to firm behaviour towards organisational routines and strategic management.

In addition, this research provided initial insights to the upgrading literature by looking at the development of firm strategies for upgrading purposes as a result of getting involved in GVCs/GPNs and other type of relationships. The upgrading literature stresses the need for increasing firm's competitiveness to sustain its position in the GVCs/GPNs vis-à-vis its rivals in other low labour cost countries and the re-location threats if the competences of the suppliers increase (which increases the labour cost). This analysis provides evidence for a link between the likelihood of process, product and managerial upgrading and the firm's ability to develop long-term strategies that aims at competence-building and leveraging. This analysis, however, does not directly investigate the strategies that target increasing competitiveness as compared to the rivals, so there is still room for investigating the role of firm strategies in firm-level upgrading.

This research has also shed some light on the spillovers through GVCs/GPNs whose effects are widely mentioned with regard to product upgrading and the development of design capabilities. For the first time, this analysis confirms that learning from knowledge spillovers during relationships is statistically significant for increasing the likelihood of product and functional upgrading. However, when internal factors are

controlled for, the results provide counter evidence for managerial upgrading while the positive effect on functional upgrading disappears. The results of the analysis for the industry differences capture the details of these relationships better. This research confirms that clothing firms (embedded in buyer-driven GVCs) are more likely to learn from knowledge spillovers in production and distribution networks and more likely to have knowledge networks with actors in their value chain. These results all confirm that there are knowledge spillover effects in GVCs/GPNs. However for food-processing firms (embedded in producer-driven chains with prospects for changing boundaries of the industry), the results show that technology acquisitions and transfers stayed within the domain of market-based arm's length relations and knowledge networks with organisations outside the production systems.

Finally, this thesis demonstrates, and offers empirical support for, the importance of the 'network' as a unit of analysis for explaining the upgrading of firms that are involved in GVCs / GPNs. While this research provides useful insight into the dynamics of various types of networks, and helps to identify some of the key network-related drivers of firm-level upgrading, one has to be aware of the potential drawbacks of these networks (especially when emerging market firms rely exclusively on them).

The empirical evidence provided by upgrading researchers to date emphasises both the potential dangers and advantages of the greater reliance of emerging market firms on GVCs/GPNs (i.e. network forms of value chain governance as opposed to hierarchical value chains) for their upgrading (e.g., see Schmitz 2004, Sturgeon 2001, and section 2.2.3). For instance, the GPN relationships of East Asian supplier firms with MNCs, especially in the electronics and automobile industries, have served as a model for analysing other emerging market firms (Hobday 1995, Ernst 2011). However, studies in Latin America and Africa, particularly in low technology industries, have provided little support to this approach; on the contrary, many of these firms have been found to be stuck in these networks (Dolan *et al.* 1999, Bazan and Navas-Aleman 2004, Gibbon 2008).

Hence, upgrading scholars have aimed to understand the impacts on supplier firms of their reliance on the support of the lead firms in these networks. They have come to a consensus about the positive impact of such patronage in networks on the product and

process upgrading of most of the firms. However, empirical evidence shows that such patronage in networks leads most of the supplier firms to lose the ability to get involved in other types of business relations than production-related ones. Consequently, they end up producing almost exclusively for the lead firms, in accordance with their specifications and standards. This even prevents them from diversifying their production capabilities and products (i.e. achieving functional upgrading). This is referred to as a lock-in effect and is a result of the fragmentation in these networks. Based on the empirical evidence, it also appears that such fragmentation limits the access of supplier firms to operations and functions outside their own organisational boundaries and to the knowledge that the lead firm is unwilling to share, and forces them to specialise exclusively in one segment of the network (Bazan and Navas Aleman 2004, Gibbon 2008, Tokatli 2007).

Moreover, with undeveloped and underdeveloped capabilities (as well as capabilities they may once have had but have since lost), these firms most often neither effectively acquire or transfer knowledge nor assimilate and use it.¹⁹⁸ The more their capabilities are limited to the production sphere, the greater the danger of being excluded from networks where knowledge is generated. Networks can be platforms where either mutual exchange of knowledge and experience (based on complementarity of capabilities) is exercised or inequality of capabilities leads to patronage, fragmentation and exclusivity. The network literature suggests that as the competence of suppliers improves and skills discrepancies narrow, the rigid governance within these networks loosens (as the lead firm perceives lowered supplier failure risk), and a more equal relationship between the lead firm and the supplier begins to develop, where mutual exchanges of ideas, advice and knowledge on products and processes take place (Freeman 1991, Freeman and Hagedoorn 1994, Powell *et al.* 1996). This, over time, allows supplier firms to establish confidence in the continuity of their routine technical (process and product) upgrading. This empirically well demonstrated side of the story of firm-level upgrading is a significant factor balancing the drawbacks of these

¹⁹⁸ Undeveloped capabilities refer to capabilities that do not exist within the firm (i.e. some firms in GVCs function simply as a production unit, as mentioned above). Underdeveloped capabilities refer to capabilities that exist within the firm but have not fully developed (i.e. at basic or intermediate level, but not at advanced level); e.g., to allow firms to take full advantage of knowledge they have access to, to catch-up or keep up with the rival firms, to innovate, and so on and alleviate the bottlenecks of being inserted in GVCs/GPNs.

networks for the supplier firms. As demonstrated by the findings of this thesis, the advantages of these networks appear to accrue to the supplier firms only after they achieve this stage of competence development, as they are able to open up to new sources of knowledge in their environment despite the drawbacks imposed as a result of their involvement in these networks (e.g., in the case of managerial upgrading).

This thesis shed light on the other side of the story, showing that only when the organisational / managerial competence of emerging market suppliers improves may opportunities for fuller forms of firm-level upgrading arise (i.e. technological upgrading extending into and complemented by managerial and functional upgrading). As a result, balancing the usefulness of these networks for accessing otherwise unavailable external knowledge and making use of learning opportunities on the one hand and the drawbacks of over-reliance on these networks on the other appear to be the key issue for successful firm-level upgrading.

9.4 POLICY IMPLICATIONS

Micro-level studies of the impact of learning in networks on upgrading in different sectoral settings can provide a fundamental input for policy-makers who are interested in promoting industrial upgrading. As this thesis shows, a combination of industrial and science and technology policies are required to be geared towards specific circumstances of the industries. The analysis of the relationship of networks and upgrading at the firm level in the years of transition is particularly important in order to understand what needed to be done for successful upgrading of the industry (and eventually the country). In addition, the years of transition for a CEE country like Poland represented a stage between transformation and EU membership when the country was expected to get prepared for the latter by achieving deep industrial integration, in other words by upgrading its firms and industries to the EU level. It is still questionable today whether Poland has achieved such integration, particularly with a focus on high-tech industries that neglects the LMT industries. As mentioned earlier, the latter industries are the key industries driving industrialisation both in the history of today's developed countries and in current experience of major emerging markets (section 1.2.2), but the producers in these industries need strong industrial policies that are developed in collaboration with industry associations, research organisations and firms.

The clothing industry has been in decline since the mid-2000s (Table 5.3 in Chapter 5) and widely experiencing the lock-in effects of GVCs/GPNs in the industry. Several reasons might be thought of. This may partly be the consequences of dependence of trade on one particular country, namely Germany, as Kaminski (1993) foresaw, and partly be the consequences of privatisation scheme followed in the clothing industry, i.e. NIF (section 5.2.5). It may be the likely impact of the abolition of import quotas by the WTO/ATC in 2005 in the industry. As this thesis shows, it clearly indicates that the restructuring of the Polish clothing industry in line with the new competitive environment within the global clothing industry has not been a successful one. The answer to this question basically lies in the catching-up literature, which deals with the link between trade and growth and emphasises the benefits from free trade through improvements in the scope for knowledge spillovers, which this research observed in the relationships of the Polish clothing firms in the GVCs/GPNs. However, this impact might be exaggerated in the literature. Again as this thesis demonstrates with evidence from large clothing firms, there is need for internal factors complementary to being inserted in GVCs/GPNs and to following competence-oriented firm strategies, which might be lacking in SMEs (by which the industry is dominated). However, this is not something that firms are solely responsible for; rather, it indicates that the government has not done a good job with regard to aligning firm-level upgrading with industrial upgrading. As discussed in section 9.2.1, similar observations in the food-processing industry were interpreted as ‘network failure’ that led to a shift from domestic to foreign sources in production and knowledge systems (von Tunzelmann 2004, 2010) and weakens the national linkages.

Although important, upgrading at the firm-level, even with intensive endogenous technological learning, organisational efforts and high level of in-house absorptive capacity, is not itself sufficient to ensure upgrading at the industry and country levels. On the one hand, firm-level upgrading is the key dimension to industrial upgrading in the emerging markets, and on the other hand, it is significantly affected by the industrial upgrading. Therefore, firm-level upgrading needs to be supported by dense industry-level linkages “in a mutually reinforcing way, so that both types of upgrading will give rise to a ‘virtuous circle’” (Ernst 2007: 442). These industry-level linkages comprise industry-university/research institute collaborations and interactions with FDI.

The literature review and statistics of the S&T system in Poland transition years in Chapter 5 showed the discrepancies that weaken the S&T system more than boosting it. Legacy of the socialist system was still present in the way S&T agents and firms were interacting, leading to a lack of conceptualisation of 'research' within the firms, among firms or between firms and universities or research institutes. Polish S&T system have continued to focus on linkages between public research institutes and industry after the transformation, and due to their weaknesses (as an outside activity for industry), Polish firms have not been stimulated to develop the capacity for learning and improvement (Radošević 1997, 1998, 1999b, Pavitt 1997, Jasinski 1997). The lessons from East Asian emerging markets have demonstrated that there is growing need for stimulating the links between industry and university and research organisations. Kim (1993, 1998b) explains the role of inter-organisational cooperation between public R&D institutes and industry established by efforts of the government in building capabilities of Korean firms; such cooperation was limited between industry and university, creating the greatest weakness of Korea's NIS. This means these links should not take place in isolation from each other but need to be converted into sectoral systems of innovation (Malerba 2002, 2005). To achieve the latter, as mentioned in section 5.3.1, the weakness of domestic institutions (i.e. universities and research institutes) have to be overcome by supporting them to increase their knowledge base (e.g., increasing GERD through financing scientific research, projects in applied research) (Radošević 1999b, 2002, Bitzer 2000, Jasinski 2003, Dyker 2004), rather than cutting their finance and laying off their highly skilled employees. Such cooperation will help increasing the knowledge base of domestic firms and their potential to be a partner for foreign firms.

So, governments also have to proactively initiate relevant policies and prepare the infrastructure for the development of systems of production and innovation where value chain actors meet industrial and research partners. There are two ways of providing this. First, the stability of networks is critical to upgrading. This thesis shows that production and distribution networks are the least troublesome in this regard mostly due to predominance of foreign actors. The cooperation with foreign firms in the production networks seems to be promising for feedback (von Hippel 1988). Moreover, direct vertical linkages between FDI and domestic suppliers help not only the latter but also domestic input producers to reap the benefits from foreign knowledge and spillovers.

However, there is a lack of stable relations with the research organisations (such as universities and research institutes) in knowledge networks (a potential source of technological knowledge) as well as with industrial partners (such as consulting firms, a potential source of business related knowledge), as they are one-off type relations. There is a need to integrate governmental support into the national networking system among the agents, first and foremost by carefully handling the R&D and innovation programmes and promoting them through sufficient resources. Such an approach to the development of innovation policies would target improving the firms' wrong perception of universities as being only for education and of research institutes as being only for basic research that has no application possibilities within the firm. Instead of undermining their research activities, firms would start collaborating for more innovative activities such as product design and development. These policies should also aim at providing strong financial support (with a substantial share of GDP) and developing a more competition-oriented incentive system to research organisations, both to encourage them to be more active in areas that ease their collaboration with the firms and to ensure their competitiveness against their foreign counterparts. Success in this area would improve the share of applied research as opposed to basic research and make applied research relevant to the functioning of the system of production and innovation. Although almost a quarter of it was lost at the beginning of transformation, Poland still has a large pool of scientists and engineers, which it has not been able to exploit. The major change a CEE country like Poland needs is a bottom-up approach followed by decentralising governance of R&D from the hands of a single institution like the Ministry of Science, which imposes a top-down approach unsuccessfully for roughly twenty years (Dyker 2004c, 2010).

In addition, as this research shows, the share and importance of networks with foreign and domestic partners in Polish clothing and food-processing industries are rather uneven: Clothing firms are predominantly involved in global production networks, while food-processing firms focus on domestic production and knowledge networks. Policy makers have to actively participate to create a balanced distribution of global and domestic networks. It is acknowledged that Polish government has been actively working on attracting FDI during transition years, one of the targets of which was food-processing industry; however, efforts for promoting linkages between MNC subsidiaries and domestic firm were meagre. At the same time, there are no policies concerning

encouraging and developing domestic backward linkages among clothing firms by means of e.g. competition, technology or regional development policies.

Governments also have to put effort into aligning these networks by means of constructive industrial policies in a way that involvement in one of them will benefit the relations in the other (von Tunzelmann 2004, 2010). Being involved in GVCs/GPNs for such a long time, to what extent have clothing firms learned leveraging competences? The analysis of this thesis indicates that there was a development of DPNs organized by large clothing firms in a similar way to GVCs/GPNs. However, to what extent this has extended into the whole industry in the 2000s and whether a positive effect has been created on the firms, for instance to internationalise their operations and their brand name, is not answered in this research. The statistics of late 2000s regarding the clothing industry are not promising. All of this indicates a need for encouragement mechanisms for clothing firms to help them recover and cultivate a new production system at home in line with global developments and market economies. As this analysis shows, food-processing firms made great efforts to establish secure supply markets by strengthening the upstream links with dense relations that transfer knowledge between the firm and its suppliers. At the time of the analysis, this development was a spillover effect from MNC subsidiaries in Poland and foreign strategic investors in Polish firms. Moreover, it was stimulated by the knowledge inflows from agri-business MNC subsidiaries. There is need for creating platforms where MNCs in the host country cooperates with the domestic firms in areas that lead to knowledge generation. Hence the need for assistance to food-processing firms to build competences through making these domestic knowledge networks efficient and effective in R&D and knowledge generation, this will, in turn, allow these firms to integrate into global knowledge networks. As a result, clothing firms need support that will save them from being locked into GVCs/GPNs, while food-processing firms need supportive policies that will open up international markets to them. Once these are achieved, the misalignment of networks can largely be eliminated. Clearly, the implementation of market reforms and privatisation in the transition years were not sufficient for effective transition of these firms (Chapter 5).

The only way to support industry-level upgrading is to develop a culture of 'cooperation' at the firm and industry levels. Governments have to be more proactive

not only in developing but mostly in implementing industry-specific S&T policies, that target support not only at industries that are characterised as high-tech industries to facilitate their integration into the global economy but also for the special requirements and needs for upgrading in LMT industries. The interview questions used in this research included a specific question about the support of governments (section 15 in Appendix D). No positive answers were given in any area relevant for the firms' upgrading efforts. This urgently calls attention to the extent of the neglect that the Polish LMT industries are undergoing. Efforts to attract FDI proved effective in the food-processing industry, while the privatisation of state-owned enterprises and their restructuring were going very slow in this industry. At the same time, while clothing firms were taking advantage of global developments in the industry, monetary policies were creating setbacks to the firms' export-based growth with the appreciation of zloty (increasing the labour cost and making firms vulnerable to the threat of shifting production from Poland to low-labour cost countries).

As a result, transformation from centrally-planned economy to market economies does not necessarily mean that government should disappear (Pavitt 1997); in fact, as von Tunzelmann (2004, 2010a) points out, strategic areas like S&T policies are not able to tolerate state withdrawal over market forces and become part of the reasons for network misalignment. Instead, governments have to take an effective part supporting LMT industries by systematic national, regional or industrial policies that create a conducive environment to firms in these industries to boost their meagre innovation, design, research and development activities through networks and not hinder the development of these firms by frequent changes of laws and sometimes damaging economic policies. They should also actively get involved in aligning networks and improving upgrading possibilities if the objective is to create a virtuous circle between firm-level and industrial upgrading. Such a circle requires the provision of the right and better circumstances for LMT firms' upgrading that focus on closing specific cognitive and competence gaps through continuous improvements (by means of learning opportunities in networks). It also requires this firm-level upgrading has to be translated into industrial upgrading where capital, infrastructure and knowledge deficiencies and coordination problems with associated research organisations are eliminated. This is crucial if governments want to develop strong systems of production and innovation made up of domestic as well as foreign actors.

9.5 AVENUES FOR FUTURE RESEARCH

This research constitutes only the first step in analysing the importance of learning in networks for firm-level upgrading. There is need for future research building on the findings of this thesis. Three research areas that need to be addressed are discussed here: Distribution networks, functional upgrading and its link with the managerial upgrading, and firm strategies for upgrading in LMT firms.

First, a follow-up research covering a period after 2001 might be useful to understand the emerging patterns of distribution networks and their role in firm-level upgrading.

Second, in order to deepen our understanding of how firms achieve functional upgrading, future research can focus not only on whether and how global or national value chains, production and knowledge networks contribute to functional upgrading but also on the capability accumulation processes within the firm for functional upgrading on longer time periods (Bell 2006). Alternatively, it is possible to replicate this type of large relationship-based, learning oriented modelling with variables for capability levels and change in them as well as with data on network density, network size, and expenditures of the firm for investments in each function upgraded over a period and so on. The link between managerial and functional upgrading is another future research topic based on aspects borrowed from human resource, knowledge and strategic management within the firm. Last but not least, in order to understand what lies behind the question of why some firms are able to functionally upgrade and some others not, analysis may also be applied to a database where firms are distinguished as successful and failure cases for functional upgrading.

Third, according to statistics, Polish food-processing industry, being the only one in the region to surpass the 1989 production level in 1999 (Hanzl 2000), has started its recovery with ups in 2001 and 2006 and downs in 2002 and 2008, while clothing industry could not stop its decline in spite of two attempts at recovery in 2002 and 2006 (section 5.2.2). Moreover, Pickles and Smith (2011) have shown that Poland has lost its market share in the EU clothing industry as a supplier country significantly over the years to other suppliers from South Europe, South East Asia and China. This difference between the two industries draws attention to the higher dependence of the clothing

firms on export markets as compared to the food-processing firms. From strategy perspective on firm-level and industry upgrading, it would be illuminating if a follow-up research on these two industries for the period after 2001 to present, if possible again with large firms, could be conducted to find out answers to questions such as whether the competition-oriented upgrading strategy of food-processing firms proved a better strategy than competence-oriented upgrading strategy of clothing firms in the domestic market and if so why, or whether it was the lock-in effect of GVCs/GPNs in the clothing industry that brought an end to the upgrading possibilities of all but a handful of firms, and if so what the main factors helping these firms to be successful were – to implement a long-term competence-building strategy or simply ceasing to be an OEM in GVCs/GPNs. In this context, in the light of the results of this study on transition years, further research can also focus on the impacts of the end of quota constrained trade in 2005, which is another milestone for the CEE clothing industry. It would be illuminating to find out whether the large firms adequately met the challenges of 2005 by the help of emerging patterns of firm-level upgrading in the clothing industry in the early 2000s and if not, what role CEE governments should assume to save the clothing industry.

Finally it is suggested that using the same framework and the same methodology, this research can be extended into other LMT industries and emerging market countries, which will provide us with an ability to compare and draw lessons. While this research has focused on indigenous LMT firms, much could be learned from replicating this research's framework and analysis methods with MNC subsidiaries operating in emerging markets. Comparing them with indigenous firms would also yield results for better understanding how to align the present but isolated networks, as discussed above.

REFERENCES

- Agresti, A. (2002) *Categorical Data Analysis*, second edition, Wiley-Interscience, New Jersey.
- Ahuja, G. (2000) "The duality of collaboration: inducements and opportunities in the formation of interfirm linkages", *Strategic Management Journal*, 21: 317-343.
- Alfranca, O., R. Rama and N. von Tunzelmann (2004) "Combining different brands of in-house knowledge: technological capabilities in food, biotechnology, chemicals and drugs in agri-food multinationals", *Science and Public Policy*, 31: 227-244.
- Almeida, P., G. Dokko, and L. Rosenkopf (2003) 'Startup size and the mechanisms of external learning: increasing opportunity and decreasing ability?', *Research Policy*, 32: 301-315.
- Anderson, R.E., S. Djankov, G. Pohl, and S. Claessons (1997) "Privatization and Restructuring in Central and Eastern Europe", *Public Policy for the Private Sector*, Note No. 123, <http://rru.worldbank.org/documents/publicpolicyjournal/123pohl.pdf>, accessed May 2010.
- Archibugi, D. and B-A. Lundvall (eds.) (2001) *The Globalizing Learning Economy*, Oxford, Oxford University Press.
- Ariffin, N. and P. N. Figueiredo (2004) "Internationalisation of innovative capabilities: counterevidence from the electronics industry in Malaysia and Brazil", *Oxford Development Studies*, 32(4): 559-583.
- Arino, A. and J. de la Torre (1998) "Learning from Failure: Towards an Evolutionary Model of Cooperative Ventures", *Organization Science*, 9(3): 306-325.
- Arrow, K.J. (1962) "The Economic Implications of Learning by Doing", *Review of Economic Studies*, 29: 155-173.
- Audretsch, D., E. Lehmann and S. Warning (2004) "University Spillovers: Does the Kind of Science Matter?", *Industry & Innovation*, 11(3):193-206.
- Axelsson, B. (1995) "The Development of Network Research – A Question of Mobilisation and Perseverance", in Möller, K. and Wilson, D. (Ed.), *Business Marketing: An Interaction and Network Perspective*, Norwell, Mass, Kluwer Academic Publishers.
- Bair, J. (2008) "Analysing economic organization: embedded networks and global chains compared", *Economy and Society*, 37(3): 339-364.
- and G. Gereffi (2001) "Local clusters in global chains: The causes and consequences of export dynamism in Torreon's Blue Jeans Industry", *World Development*, 29(11): 1885-1903.
- Balcerowicz, L. (1993) "Common Fallacies in the debate on the economic transition in CEE", *EBRD Working Paper*, No.11, EBRD.
- Balcerowicz, E., A. Wziatek-Kubiak and M. Peczkowski (2009) "The innovation patterns of firms in low and high technology manufacturing sectors in the new member states", *CASE Network Studies and Analyses*, No. 309, CASE Warsaw.
- Baron, R.M. and D.A.Kenney (1986) "The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations", *Journal of Personality and Social Psychology*, 51(6): 1173-1182.
- Barner-Rasmussen, W., and I. Bjorkman (2005) "Surmounting interunit barriers: Factors associated with inter-unit communication intensity in the multinational corporation", *International Studies of Management & Organization*, 35(1): 28-46.
- Barney, J.B. (1991) "Firm resources and sustained competitive advantage", *Journal of Management*, 17(1): 99-120.

- Bartholomew, D.J., F. Steele, I. Moustaki and J.I. Galbraith (2002) *The Analysis and Interpretation of Multivariate Data for Social Scientists*, Chapter 4: Correspondence Analysis, Chapman and Hall/CRC: Boca Raton, Florida.
- Baruk, J. (1997) "Innovativeness of Polish enterprises in the initial period of system transformation", *Technovation*, 17(9): 477-489.
- Bazan, L. and Navas-Aleman (2004) "The underground revolution in the Sinos Valley: A comparison of upgrading in global and national value chains", in H. Schmitz (ed.) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK, pp.110-139.
- Begg, R., J. Pickles and A. Smith (2003) "Cutting it: European integration, trade regimes and the reconfiguration of East-Central European apparel production", *Environment and Planning A*, 35(12): 2191-2207.
- Belka, M. (2001) "Lessons from the Polish Transition", in G. Blazycy and R. Rapacki (eds), *Poland into the New Millennium*, Economies and Societies in Transition series, Edward Elgar: Cheltenham, UK.
- Bell, M. (2006) "Time and Technological Learning in Industrialising Countries: How long does it take? How fast is it moving (if at all)?", *Journal of Technology Management*, 36 (1/2/3): 25-39.
- (1997) "Technology Transfer to transition countries: are there lessons from the experience of the post-war industrialising countries?", in D. Dyker (ed.), *The Technology of Transition. Science and Technology Policies for Transition Countries*, Central European University Press, Budapest.
- (1984) "'Learning' and the Accumulation of Industrial Technological Capacity in Developing Countries", in M. Fransman and K. King (1984), *Technological Capability in the Third World*, London, The Macmillan Press Ltd., pp.187-209.
- Bell, M. and M. Albu (1999) "Knowledge Systems and Technological Dynamism in Industrial Clusters in Developing Countries", *World Development*, 27(9):1715-1734.
- Bell, M. and K. Pavitt (1995) "The development of Technological Capabilities", in I. ul Hague (ed), *Trade, Technology, and International Competitiveness*, (in collaboration with M. Bell, C. Dahlman, S. Lall, K. Pavitt), EDI Development studies, Economic Development Institute of the World Bank, The World Bank, Washington, D.C.
- Bell, M. and K. Pavitt (1993) "Technological Accumulation and Industrial Growth: Contrasts between developed and developing countries", *Industrial and Corporate Change*, 2(2): 157-210.
- Belussi, F. and F. Arcangeli (1998) "A Typology of Networks: flexible and evolutionary firms", *Research Policy*, 27: 415-428.
- Berger, S., C. Kurz, T. Sturgeon, U. Voskamp, and V. Wittke (2001), *Globalization, Production Networks, and National Models of Capitalism - On the Possibilities of New Productive Systems and Institutional Diversity in an Enlarging Europe*, SOFI-Mitteilungen, 29: 59-72.
- Bessant, J. and D. Francis (1999) "Using learning networks to help improve manufacturing competitiveness", *Technovation*, 19: 373-381.
- , R. Kaplinsky and M. Morris (2003) "Developing capability through learning networks", *International Journal of Technology Management & Sustainable Development*, 2(1): 19-38.
- Bijman, J.W. (1996), "Biotechnology and vertical integration in the Dutch Potato Chain", in Galizzi G. and L. Venturini (eds.), *Economics of Innovation: The Case of Food-processing Industry*, Physica-Verlag Heidelberg, pp.307-318.
- Bitzer, J. (2000) "An Evolutionary View of Post-socialist Restructuring: Science and

- Technology Systems to Innovation Systems”, in C. von Hirschhausen and J. Bitzer (eds), *The globalization of industry and innovation in Eastern Europe: from post-socialist restructuring to international competitiveness*, Cheltenham: Edward Elgar.
- Blanchard, O. and M. Kremer (1997) “Disorganization”, *Quarterly Journal of Economics* 112(4): 1091-1126.
- Blanchfield, (1983) “Technological change in food manufacturing and distribution”, in J. Burns, J. McInerney and A. Swinbank (eds), *The Food Industry; Economics and Politics*, London: Heinemann, pp. 81-179.
- Blanke-Ławniczak, K. (2009) “Marketing Dynamics and Management Excellence: The Sources of Successful Internationalization of a Food-processing Company from a Transition Economy (Case: MASPEX—Poland)”, *Journal of International Food-processing & Agribusiness Marketing*, 21(2): 134-148.
- Błaszczuk, B. (1999) “Moving Ahead: Privatization in Poland”, *Economic Reform Today*, No.2, www.Cipe.Org/Publications/Ert/E32/E32_6.Pdf, accessed may 2010.
- Borooah, V.K. (2002) *Logit and Probit: Ordered and Multinomial Models*, Sage University paper.
- Borras, M. (1997) “Left for Dead: Asian Production Networks and the Revival of US Electronics”, *BRIE Working Paper* 100.
- and J. Zysman (1997) “Globalization with Borders: the Rise of Wintelism as the Future of Industrial Competition”, *Industry and Innovation*, 4(2): 141-166.
- , D. Ernst and S. Haggard (eds.) (2000) *International Production Networks in Asia. Rivalry or Riches?*, Routledge, London.
- Bönte, W. and M. Keilback (2005), “Concubinage or marriage? Informal and formal cooperations for innovation”, *International Journal of Industrial Organization*, 23:279-302.
- Brass, D. J., J. Galaskiewicz, H. R. Greve, And W. Tsai (2004) “Taking Stock of Networks and Organizations: A Multilevel Perspective”, *Academy Of Management Journal*, 47(6): 795–817.
- Britto, J. (1998) “Technological Diversity and Industrial Networks: An Analysis of the *Modus Operandi* of Co-operative Arrangements”, *SPRU Electronic Working Paper Series*, Paper No 4, Brighton, SPRU, University of Sussex
- Brown, J.S. and P. Duguid (1991) “Organisational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning and Innovation”, *Organisation Science*, 2(1): 40-57.
- Byrne, C. (1995) *Impact of new technology in the clothing industry: outlook to 2000*. David Rigby Associates, *Textile Outlook International*.
- Carlin, W. and M. Landesmann (1997) “From Theory into Practice? Corporate Restructuring and Dynamism in Transition Economies”, *Oxford Review Of Economic Policy*, 13(2): 77-105.
- Carlsson, B. (1994) ‘Technological Systems and Economic Performance’, in M. Dodgson and R. Rothwell (eds.), *The Handbook of Industrial Innovation*, Edward Elgar, Aldershot.
- Carlsson, B. (ed.) (1995) *Technological Systems and Economic Performance*, Kluwer Academic Publishers, Dordrecht.
- Carlsson, B. and G. Eliasson (1995) “The Nature and Importance of Economic Competence”, in Bo Carlsson (ed), *Technological Systems and Economic Performance: The case of Factory Automation*, Dordrecht: Kluwer Academic Publishers, 57-87.
- Carlsson, B. and R. Stankiewicz (1991) “On the nature, function and composition of technological systems”, *Journal of Evolutionary Economics*, 1(2): 93-118.

- Cassiman, B. and R. Veugelers (2002) "R&D Cooperation and Spillovers: Some Empirical Evidence from Belgium", *The American Economic Review*, 92(4): 1169-1184.
- Caves, R.E. (1999) "Spillovers from multinational in developing countries: The mechanisms at work", *Working Paper No. 247*, William Davidson Institute Conference on "The Impact of Foreign Investment on Emerging Markets", School of Business Administration, University of Michigan, Ann Arbor.
- Central Statistical Office of Poland (2009) Science and Technology in Poland 2007, Warsaw, http://www.stat.gov.pl/gus/5840_800_ENG_HTML.htm, accessed May 2010.
- (2006) Science and Technology in Poland 2005, Warsaw.
 - (2005) Main Science and Technology Indicators in Poland 2000-2003, Warsaw, http://www.stat.gov.pl/gus/5840_2793_ENG_HTML.htm, accessed May 2010.
 - (2002) Innovation Activities in Industrial Enterprises in Poland 1998-2000, Warsaw.
 - (1999) *Science and Technology in Poland 1997*, Warsaw.
- Cimoli, M. and R. Constantino (2000) "Systems of innovation, knowledge and networks: Latin America and its capability to capture benefits", in R.E. Lopez-Martinez and A. Piccaluga (eds.), *Knowledge Flows in National Systems of Innovation. A Comparative Analysis of Sociotechnical Constituencies in Europe and Latin America*, Edward Elgar, Cheltenham.
- Chandler, A.D. Jr (1977) *The Visible Hand*, Cambridge, Massachusetts, The Belknap Press of Harvard University Press
- Chandler, A.D. Jr (1996) "Corporate Strategy, Structure and Control Methods in the United States during the Twentieth century" in G. Dosi and F. Malerba (eds.), *Organization and Strategy in the Evolution of the Enterprise*, London, MacMillan, pp.223-245.
- Chataway, J. (1999) "Technology transfer and the restructuring of science and technology in central and eastern Europe", *Technovation*, Volume 19, Issues 6-7 : 355-364.
- Chesnais, F. (1992) "National Systems of Innovation, Foreign Direct Investment and the Operations of Multinational Enterprises", in Lundvall, B.-Å.(ed.), *National Systems of Innovation*, London, Pinter Publishers.
- Chesnais, F. (1996) "Technological agreements, networks and selected issues in economic theory", in R. Coombs, A. Richards, P. Saviotti, and V. Walsh (eds.), *Technological Collaboration: the dynamics of cooperation in industrial innovation*, Cheltenham: Edward Elgar.
- Child, J. and A.P. Czegledy (1996) "Managerial Learning in the transformation of Eastern Europe: Some Key Issues", *Organization Studies*, 17(2): 167-179.
- Christensen, J.L., R. Rama and N. von Tunzelmann (1996), *The European Food and Beverages Industry*, European Information Monitoring System (EU), Luxembourg.
- Christofides, C. (1994) "The Supply Response: Microeconomic Liberalization, Sectoral Developments and the Labor Market", in Ebrill, L.P. *et al.*, *Poland: The Path to a Market Economy*, IMF, Washington D.C., Occasional Paper No. 113.
- Chudnovsky, D., A. Lopez and G. Pupato (2006) "Innovation and productivity in developing countries: A study of Argentine manufacturing firms' behavior (1992-2001)", *Research Policy*, 35: 266-288
- Chung S, Singh H, Lee K. (2000) "Complementarity, status similarity and social capital as drivers of alliance formation", *Strategic Management Journal*, 21(1):1-22.
- Coe, N. M., Hess, M., Yeung, H. W-C., Dicken, P., Henderson, J. (2004) "Globalizing

- regional development: a global production networks perspective”, *Transactions of the Institute of British Geographers*, 29: 468–484.
- Coe, N.M., P. Dicken and M. Hess (2008) “Introduction: global production networks – debates and challenges”, *Journal of Economic Geography* 8: 267–269.
- (2008b), “Global production networks: realizing the potential”, *Journal of Economic Geography* 8: 271–295.
- Cohen, W. M. and D.A. Levinthal (1989) “Innovation and learning: The two faces of R&D”, *Economic Journal*, 99: 569–596.
- (1990) “Absorptive capacity: A New Perspective on Learning and Innovation”, *Administrative Science Quarterly*, 35:128–152.
- Commission of the European Communities (2003) “Impact of Enlargement on Industry”, Commission Staff Working Paper, Brussels, SEC(2003) 234.
- Comisso, E. (1998) “‘Implicit’ Development Strategies in Central East Europe and Cross-National Production Networks”, *BRIE Working Paper* 129.
- Community Innovation Survey (1997) *Core Questionnaire, Annex I, CIS - Second – Questionnaires, Manufacturing Sector*, Eurostat.
- Connor, J.M. and W.A.Schiek (1997) *Food-processing Processing: An industrial powerhouse in transition*, New York: John Wiley & Sons, Inc., second edition.
- Connor-Linton, J. (2003) *Chi-Square Tutorial*, Department of Linguistics, Georgetown University; available at http://www.georgetown.edu/faculty/ballc/webtools/web_chi_tut.html
- Contractor, F. J., 1998(a), ‘Technology Acquisition Policies in Emerging Markets’, in F.J. Contractor (ed.), *Economic Transformation in Emerging Countries. The Role of Investment, Trade and Finance*. Series in International Business and Economics, Elsevier, Oxford.
- Contractor, F. J. and T. Sagafi-Nejad (1981) “International Technology Transfer: Major Issues and Policy Responses”, *Journal of International Business Studies*, 12(2): 113–135.
- Contractor, F. J. and P. Lorange (1988) “Why Should Firms Cooperate? The Strategy and Economics Basis for Cooperative Ventures”, in F. J Contractor and P. Lorange (eds.), *Cooperative Strategies in International Business. Joint Ventures and Technological Partnerships between Firms*, Lexington: Lexington Books, KY, 3–30.
- (2002) “The growth of alliances in the knowledge-based economy”, *International Business Review*, 11: 485–502.
- Cook, K.S. and R. M. Emerson (1978) “Power, Equity and Commitment in Exchange Networks”, *American Sociological Review*, 43(5): 721–739.
- Coombs, R., A. Richards, P.P. Saviotti, and V. Walsh (eds.) (1996) *Technological Collaboration: the dynamics of cooperation in industrial innovation*, Cheltenham: Edward Elgar.
- Coombs, R. and J.S. Metcalfe (2000) “Organizing for Innovation: Coordinating Distributed Innovation Capabilities”, in N. Foss and V. Mahnke (eds.), *Competence, Governance and Entrepreneurship. Advances in Economic Strategy Research*, Oxford, Oxford University Press, pp. 209–231.
- Czepiel, J.A. (1974) “Word-of-Mouth Processes in the Diffusion of Major Technological Innovation”, *Journal of Marketing Research*, 11 (May): 172–180.
- Dahl, M.S. and C. Ø.R. Pedersen (2004) “Knowledge flows through informal contacts in industrial clusters: myth or reality?”, *Research Policy* 33: 1673–1686.
- Dahlman, C. J. and F.V. Fonseca (1987) “From Technological Dependence to

- Technological Development: The Case of the USIMINAS Steel Plant in Brazil”, in J. Katz, (ed.) (1987) *Technology Generation in Latin American Manufacturing Industries*, New York: St Martin’s Press, pp.154-181.
- Daim, T.U. and D.F. Kocaoglu (2008) “Exploring technology acquisition in Oregon, Turkey and in the US electronics manufacturing companies”, *Journal of High Technology Management Research*, 19:45-58.
- Damijan, J., M. Knell, B. Majcen and M. Rojec (2003) “The role of FDI, R&D accumulation and trade in transferring technology to transition countries: Evidence from firm panel data for eight transition countries”, *Economic Systems*, 27(2):189-204.
- Damijan, J., C. Kostevc and M. Rojec (2013) “Global Supply Chains at Work in Central and Eastern European Countries: Impact of FDI on export restructuring and productivity growth”, LICOS Discussion Paper Series, 332/2013, LICOS Centre for Institutions and Economic Performance, Katholieke Universiteit Leuven, Belgium.
- Damijan, J., M. Rojec, B. Majcen and M. Knell (2013) “Impact of firm heterogeneity on direct and spillover effects of FDI: Micro-evidence from ten transition countries”, *Journal of Comparative Economics*, 41(3):895-922.
- Dantas, E. and Bell, M. (2009) “Latecomer firms and the emergence and development of knowledge networks: The case of Petrobras in Brazil”, *Research Policy*, 38: 829-844.
- (2011) “The Co-Evolution of Firm-Centered Knowledge Networks and Capabilities in Late Industrializing Countries: The Case of Petrobras in the Offshore Oil Innovation System in Brazil”, *World Development*, 39(9):1570-1591.
- David, P.A. and Foray, D. (1995) “Accessing and expanding the science and technology knowledge base”, *STI Review*, No.16, OECD, pp.13-68.
- Demsetz, H. (1991) ‘The theory of the firm revisited’, in O.E. Williamson and S. Winter (eds), *The Nature of the Firm*. New York: Oxford University Press, 159–78.
- Dicken, P. (1992) *Global Shift: The Internationalisation of Economic Activity*, London: Paul Chapman Publishing.
- Dicken, P. and Henderson, J. (2003) “Globalizing regional development: A global production networks perspective”, <http://www.art.man.ac.uk/Geog/gpn/pdfs/gpnwp.pdf>, GPN Working Paper 3 within Dicken, P. and Henderson, J. (2003) Making the connections: global production networks in Europe and East Asia. ESRC Research Project R000238535, <http://www.sed.manchester.ac.uk/geography/research/gpn/gpnwp3.pdf>
- Djankov S. and P. Murrell (2000) *The determinants of enterprise restructuring in transition: An assessment of the evidence*, Washington, D.C., World Bank.
- Dolan, C., J. Humphrey and C. Harris-Pascal (1999) “Horticulture Commodity Chains: The impact of the UK market on the African Fresh Vegetable Industry”, *Institute of Development Studies, Working Paper No:96*, University of Sussex.
- Dodgson, M. (1990) “Strategy and Technological Learning. An interdisciplinary microstudy”, paper prepared for the international conference *Firm Strategy and Technological Change: Micro Economics or Micro Sociology* organized by the Manchester School of Management, UMIST and Department of Economics, Manchester University, 27-28 September 1990.
- Dosi, G. (1988) “Sources, Procedures, and Microeconomic Effects of Innovation”, *Journal of Economic Literature*, 24: 1120-1171.
- Doz, Y. (1996) “The Evolution of Cooperation in Strategic Alliances: Initial Conditions or Learning Processes?”, *Strategic Management Journal*, 17: 55-83, Special Issue:

Evolutionary Perspectives on Strategy.

- Doz, Y. and C.K. Prahalad (1988) "Quality of Management: An emerging source of global competitive advantage?", in N. Hood and J.E. Vahlne (eds.), *Strategies in global competition*, London, Croom Helm, pp.345-369.
- Doz, Y., P.M. Olk, and P.S. Ring (2000) "Formation processes of R&D Consortia: Which path to take? Where does it lead?", *Strategic Management Journal*, 21: 239-266.
- Dulleck, U., N. Foster, R. Stehrer and J. Woerz (2005) "Dimensions of Quality Upgrading", *Economics of Transition*, 13(1): 51-76.
- Dunford, M. (2004) "The changing profile and map of the EU Textile and clothing industry", in Faust, M., Voskamp, U., Wittke, V. (eds.), *European Industrial Restructuring in a Global Economy: Fragmentation and Relocation of Value Chains*, SOFI Berichte, Goettingen, pp.295-318.
- Duponcel, M. (1998) "Restructuring of Food-processing Industries in the Five Central and Eastern European Front-runners towards EU Membership (CEEC-5). A Comparative Review", Centre for Economic Reform and Transformation, Department of Economics, Heriot-Watt University, Edinburgh, *CERT Discussion Paper* No:98/6, www.hw.ac.uk/ecoWWW/cert/certhp.htm, 1998.
- Duysters, G. and J. Hagedoorn (2000) "International Technological Collaboration: Implication for Newly Industrializing Economies", in L. Kim and R. Nelson (eds.), *Technology, Learning and Innovation. Experiences of Newly Industrializing Economies*, Cambridge, Cambridge University Press.
- Dutrenit, G. (2000) *Learning and Knowledge Management in the Firm*, Edward Elgar, Cheltenham.
- Dyer, J.H. and H. Singh (1998) "The relational view: Co-operative strategy and sources of interorganizational competitive advantage", *Academy of Management Review*, 23:660-679.
- Dyer, J.H. and Nobeoka, K. (2000) "Creating and managing a high-performance knowledge-sharing network: the Toyota case", *Strategic Management Journal* 21(3): 345-368.
- Dyker, D.A. (2010) "The Governance and Management of Technical Change in Transition Countries", in D.A. Dyker (ed.) *Network Dynamics in Emerging Regions of Europe*, Imperial College Press, London, pp.63-86.
- (2004) *Catching up and Falling Behind: Post-Communist Transformation in Historical Perspective*, Imperial College Press, London.
- (2004b) "Technology and Structure in the Polish Economy under transition and globalisation", in D.A. Dyker, *Catching up and Falling Behind: Post-Communist Transformation in Historical Perspective*, Imperial College Press, London, pp.87-114.
- (2004c) "The dynamic impact on the Central-East European economies of accession to the European Union social capability and technology absorption", in D.A. Dyker, *Catching up and Falling Behind: Post-Communist Transformation in Historical Perspective*, Imperial College Press, London, pp.139-170.
- (2004d) "Key actors in the process of innovation and technology transfer in the context of economic transition", in D.A. Dyker, *Catching up and Falling Behind: Post-Communist Transformation in Historical Perspective*, Imperial College Press, London, pp.203-216.
- (ed.) (1997) *The Technology of Transition. Science and Technology Policies for Transition Countries*, Central European University Press, Budapest.

- , A. Nagy, P. Stanovnik, J. Turk, H. Usenik, P. Vince (2003) “‘East’–‘West’ networks and their alignment: industrial networks in Hungary and Slovenia”, *Technovation*, 23: 603–616.
- and N. von Tunzelmann (2002) ‘Network Alignment in firms in Transition Countries: A Survey of Hungarian and Slovenian Companies’, mimeo, University of Sussex.
- Easterby-Smith, M., M. A. Lyles and E.W. K. Tsang (2008) “Inter-Organizational Knowledge Transfer: Current Themes and Future Prospects”, *Journal of Management Studies* 45:4, 677-690.
- EBRD Transition Report (2004) *Infrastructure*, EBRD, London, UK.
- (2000) *Employment, skills and transition*, EBRD, London, UK.
- (1999) *Ten years of transition*, EBRD, London, UK.
- (1998) *Financial sector in transition*, EBRD, London, UK.
- (1997) *Enterprise performance and growth*, EBRD, London, UK.
- (1996) *Infrastructure and savings*, EBRD, London, UK.
- (1995) *Investment and Enterprise Development*, EBRD, London, UK.
- (1994) *Institutional reform and economic openness*, EBRD, London, UK.
- Economic bulletin for Europe (1991) “Overview of eastern economic relations with the west”, vol 43, p.87.
<http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=9610173708&site=ehost-live>)
- Eichengreen, B. and Kohl R. (1998) “The External Sector, the State and Development in Eastern Europe”, *BRIE Working Paper* 125.
- Edquist C. (2001) “Innovation Policy – A systemic approach”, in D. Archibugi and B-A.Lundvall (eds.), *The Globalizing Learning Economy*, Oxford, Oxford University Press, pp.219-238.
- (1997) *Systems of Innovation: Technologies, Institutions and Organizations*, Pinter Publishers, London.
- Edquist, C., L. Hommen and M. McKelvey (2001) *Innovation and Employment, Process versus Product Innovations*, Cheltenham: Edward Elgar.
- Edquist, C. and B. Johnson (1997) “Institutions and organisations in systems of innovation”, in C. Edquist, *Systems of Innovation: Technologies, Institutions and Organizations*, Pinter Publishers, London.
- Ernst, D. (2009) “A New Geography of Knowledge in the Electronics Industry: Asia’s Role in Global Innovation Networks”, *East-West Center Policy Studies*, No. 54.
- (2008) “Can Chinese IT Firms Develop Innovative Capabilities Within Global Knowledge Networks?”, *East-West Center Working Papers, Economics Series*, 94.
- (2007) “Beyond the Global Factory Model: Innovative Capabilities for Upgrading China’s IT Industry”, *International Journal of Technology and Globalization*, 3(4): 437-460.
- (2006) “Searching for a new role in east asian regionalization: Japanese production networks in the electronics industry”, in Katzenstein, P.J. and T. Shiraishi (eds), *Beyond Japan: The Dynamics of East Asian Regionalism*, Cornell University Press: New York, pp.161-210.”
- (2001) “Global Production networks and Industrial Upgrading – A Knowledge Centred Approach”, *East-West Center Working Papers, Economics Series*, No. 25.
- (2000a), “Inter-Organizational Knowledge Outsourcing. What Permits Small Taiwanese Firms to Compete in the Computer Industry?”, *Asia Pacific Journal of Management*, special issue on “Knowledge Management in Asia”.

- (2000b) "Carriers of cross-border knowledge diffusion: Information Technology and Global Production Networks", *East-West Centre Working Paper* No.3 (June 2000).
- (1998) "Catching-Up, Crisis and Industrial Upgrading. Evolutionary Aspects of Technological Learning in Korea's Electronics Industry ", *Asia Pacific Journal of Management*, Volume 15 (2): 247-283.
- (1997) "From Partial to Systemic Globalization: International Production Networks in the Electronics Industry", *BRIE Working Paper* 98.
- and L. Kim (2002) "Global production networks, knowledge diffusion, and local capability formation", *Research Policy*, 31 (2002) 1417-1429
- and B-A Lundvall (2000) "Information Technology in the Learning Economy: Challenges for Developing Countries", *Economics Study Area Working Papers* 08, East-West Center, Economics Study Area.
- , T. Ganiatsos and L. Mytelka (eds.) (1998) *Technological Capabilities and Export Success - Lessons from East Asia*, Routledge Press, London.
- Eurostat Statistics, ec.europa.eu/eurostat, (accessed April 2010)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dade&lang=en
- Figueiredo, P.N. (2003), "Learning, capability accumulation and firm differences: evidence from latecomer steel", *Industrial and Corporate Change*, 12(3):607-643.
- (2010) "Uncovering the learning mechanisms underlying pathways of disruptive innovation capability accumulation in latecomer natural resource-processing firms: Evidence from Brazil", paper presented in Druid Summer Conference, June 15 - 18, 2010.
- (2003) "Learning, capability accumulation and firms differences: evidence from latecomer steel", *Industrial and Corporate Change*, 12(3):607-643.
- Fiol, C. M. and M. A. Lyles (1985) "Organizational Learning" *Academy of Management Review*, 10: 803-813.
- Fransman, M. (1986) *Technology and Economic development*, Wheatsheaf Books Ltd., Great Britain.
- Freddi, D. (2009) "The integration of old and new technological paradigms in low- and medium-tech sectors: The case of mechatronics", *Research Policy*, 38: 548-558.
- Freeman, C. (1995) "The National System of Innovation in Historical Perspective", *Cambridge Journal of Economics*, 19(1): 5-24.
- (1994) "Innovation and Growth", in M. Dodgson and R. Rothwell (eds.) *The Handbook of Industrial Innovation*, Aldershot, Edward Elgar, pp.78-93.
- (1992) "Formal Scientific and Technical Institutions in the National Innovation Systems", in B.-Å. Lundvall (ed.), *National Systems of Innovation*, London, Pinter Publishers.
- (1991) "Network of innovators: A synthesis of research issues", *Research Policy*, 20: 499-514.
- (1987) "Technology and economic performance: Lessons from Japan", Pinter Publishers, London.
- Freeman, C. and J. Hagedoorn (1994) "Catching Up or Falling Behind: Patterns of International Interfirm Technology Partnering", *World Development*, 22(5): 771-780.
- Freeman, C. and L. Soete (1997) *The Economics of Industrial Innovation*, third edition, Pinter, London.
- Friedlander, F. (1983), "Patterns of Individual and Organizational Learning," in S. Srivastva and Associates (eds.), *The Executive Mind: New Insights on Managerial Thought and Action*. San Francisco: Jossey-Bass.
- Fritsch, M. (2001) "Innovation by Networking: An Economic Perspective", in K.

- Koschatzky, M. Kulicke and A. Zenker (eds.), *Innovation Networks, Concepts and Challenges in the European Perspective*, Heidelberg, Physica-Verlag.
- Fritsch, M. and G. Franke (2004) "Innovation, regional knowledge spillovers and R&D cooperation", *Research Policy*, 33: 245–255.
- Galaskiewicz, J. (1985) "Interorganisational Relations", *American Review of Sociology*, 8: 281–304.
- Galizzi G. and L. Venturini (eds.) (1996) *Economics of Innovation: The Case of Food-processing Industry*, Physica-Verlag Heidelberg.
- Gamureac, S. (Evans & Associates) (2003) *Innovation policy in seven candidate countries: the challenges, Innovation Policy Profile: Romania*, Final Report, Volume 2.5, Study coordinated by ADE, in association with SSEES and LOGOTECH, Enterprise Directorate-General, Contract No: INNO-02-06, available at http://www.cordis.lu/innovation-policy/studies/geo_study3.htm
- Garette, B. and P. Dussauge (2000) "Alliances Versus Acquisitions: Choosing the Right Option", *European Management Journal*, 18 (1): 63–69.
- Garten, J. E. (1996) "The big emerging markets", *Columbia Journal of World Business* 31 (2): 7–31.
- Garvin, D. (1993) "Building a learning organisation", *Harvard Business Review*, July-August, 78–91.
- Gelsing, L. (1992) "Innovation and the Development of Industrial Networks", in B.-Å. Lundvall (ed.) *National Systems of Innovation*, London, Pinter Publisher, 116–127.
- (1989) "Knowledge networks, industrial flexibility, and innovation", in F. Borum and P.H. Kristensen (eds.), *Technological innovation and organisational change – Danish patterns of knowledge, networks and culture*, Danish Social Science Research Council, Copenhagen.
- Gentile-Lüdecke, S. and A. Giroud (2009) "Does the East Learn from the West? How Polish Automotive Suppliers Learn from Western MNEs", *Journal of East-West Business*, 15(3): 271–294.
- Gereffi, G. (2001) "Beyond the Producer-driven/ Buyer-driven Dichotomy: The evolution of Global Value Chains in the Internet Era", in G. Gereffi and R. Kaplinsky (eds.), *The Value of Value Chains: Spreading the Gains from Globalisation*. Special issue of IDS Bulletin. 32(3): 30–40. IDS, University of Sussex, Brighton.
- (1999a) "International Trade and Industrial Upgrading in the Apparel Commodity Chain", *Journal of International Economics*, 48: 37–70.
- (1999b) "Industrial Upgrading In The Apparel Commodity Chain: What Can Mexico Learn From East Asia?", paper present at the *International Conference on Business Transformation and Social Change in East Asia*, Tunghai University Institute of East Asian Societies and Economies, Taichung, Taiwan, June 10–11, 1999.
- (1995) "Global Production Systems and Third World Development", in B. Stallings, (ed.), *Global Change, Regional Response: The New International Context of Development*, Cambridge: Cambridge University Press, 100–142.
- (1994) "The organisation of buyer-driven commodity chains: how US retailers shape overseas production networks", in G. Gereffi and M. Korzeniewicz (eds.) *Commodity chains and global capitalism*. Westport: Greenwood Press, 95–122.
- Gereffi, G. and M. Korzeniewicz (eds) (1994) *Commodity chains and global capitalism*, Westport, Praeger.
- Gereffi, G. and T. Tam (1998), "Industrial upgrading through organizational chains:

- Dynamics of rent, learning, and mobility in the global economy,” paper presented at the 93rd annual meeting of the American Sociological Association, San Francisco, CA, August 21-25.
- Gereffi, G. and O. Memedovic (2003) “The Global Apparel Value Chain: What Prospects for Upgrading by Developing Countries”, UNIDO, Sectoral Studies Series, Vienna, 2003.
- Gereffi, G., J. Humphrey and T. Sturgeon (2005) “The Governance of Global Value Chains”, *Review of International Political Economy*, 12(1): 78-104.
- Geroski, P. and M. Mazzucato (2002) “Learning and the sources of corporate growth”, *Industrial and Corporate Change*, 11(4):623-244.
- Gibbon, P. (2008) “Governance, Entry Barriers, Upgrading: A Re-Interpretation of Some GVC Concepts from the Experience of African Clothing Exports”, *Competition and Change*, 12(1): 29-48.
- (2001) “Upgrading primary production: a global commodity chain approach”, *World Development*, 29 (2): 345-63
- (2000) “Back to the Basics through Delocalisation: The Mauritian Garment Industry at the End of the Twentieth Century”, *CDR Working Paper 00-7*, Copenhagen: Centre for Development Research.
- Giuliani, E., C. Pietrobelli and R. Rabellotti, (2005), “Upgrading in Global Value Chains: Lessons from Latin American Clusters”, *World Development*, 33 (4), 549–573.
- Giuliani, E. and M. Bell (2005) “The micro-determinants of meso-level learning and innovation: evidence from a Chilean wine cluster”, *Research Policy*, 34: 47–68.
- Ghoshal, S. and C.A. Bartlett (1990) “The Multinational Corporation as an Interorganizational Network”, *Academy of Management Review*, 15(4):603-625.
- Ghoshal, S., Korine, H., & Szulanski, G. (1994) “Inter-unit communication in multinational corporations”, *Management Science*, 40(1): 96-110.
- Godinho, M.F.C.M. (1993) *Innovation diffusion in the Portuguese and Italian clothing industry*, SPRU DPhil thesis, Vol 1.
- Goh, S. and G. Richards (1997) “Benchmarking the Learning Capability of Organizations”, *European Management Journal*, 15(5):575-583.
- Gomulka, S. (2000) “Macroeconomic Policies and Achievements in Transition Economies, 1989-1999”, *Centre for Economic Performance Discussion Paper 475*, London School of Economics and Political Science, London, <http://eprints.lse.ac.uk/20160/>
- Gorynia, M. and R. Wolniak (2000) “Foreign Direct Investment and Competition Strategies of Domestic Firms in Poland”, in M.A. Weresa (ed.) *Foreign Direct Investment in a Transition Economy, The Polish Case*, School of Slavonic and East European Studies, University College London, London.
- Grabher, G. (ed.) (1993) *The Embedded Firm – On the socioeconomics of industrial networks*, London, Routledge.
- Grandstrand, O., P. Patel and K. Pavitt (1997) “Multi-technology corporations: Why they have ‘distributed’ rather than ‘distinctive core’ competencies”, *California Management Review*, Berkeley, Summer, 39(4): 8-25.
- Granovetter, M. (1985) “Economic action and social structure: A theory of Embeddedness”, *American Journal of Sociology*, 91: 481–510.
- (1973) ‘The strength of weak ties’, *American Journal of Sociology*, 78: 1360-1380.
- Grant, R.M. (1996) “Toward a knowledge-based theory of the firm”, *Strategic Management Journal*, 17(Winter Special Issue): 109-122.

- Graziani, G. (1998) "Globalization of Production in the Textile and Clothing Industries: The Case of Italian Foreign Direct Investment and Outward Processing in Eastern Europe", *BRIE Working Paper* 128.
- Green, R.H., L. Lanini and B. Schaller (1996) "Technical and organisational innovations in the food system: The case of French products in France", in G. Galizzi and L. Venturini (eds.), *Economics of Innovation: The Case of Food-processing Industry*, Physica-Verlag Heidelberg, 355-368.
- Greene, W.H. (2008) *Econometric analysis*, Upper Saddle River, New Jersey, 6th edition.
- (2003) *Econometric analysis*, Upper Saddle River, New Jersey, 5th edition.
- Griffith, R., S. Redding and H. Simpson. 2004. Foreign Ownership and Productivity: New Evidence from the Service Sector and the R&D Lab. *CEP Discussion Paper No 649 (September)*. Centre for Economic Performance, London School of Economics and Political Science, London.
- Griliches, Z. 1979. Issues in Assessing the Contribution of R&D to Productivity Growth, *Bell Journal of Economics*, 10: 92-116.
- (1992) "The Search for R&D spillovers", *Scandinavian Journal of Economics*, 94: 29-47.
- Grossman, G.M. and E. Helpman (1991) "Trade, Knowledge Spillovers and Growth", *European Economic Review*, 35:3, 517-26.
- Guardjian, P., G. Kerschbaumer, M. Kliger and J. Waterous (2000) "Bagging Europe's Groceries", *The McKinsey Quarterly*, No.2: Europe, pp.68-75.
- Gulati, R. (1999) "Network location and learning: The influence of network resources and firm capabilities on alliance formation", *Strategic Management Journal*, 20(5): 397-420.
- (1998) "Alliances and networks", *Strategic Management Journal*, 19(4):293-317.
- (1995) "Does Familiarity Breed Trust? The Implications of Repeated Ties for Contractual Choice in Alliances", *Academy of Management Journal*, 38(1): 85-112.
- Gulati, R., N. Nohria, and A. Zaheer (2000). 'Strategic networks', *Strategic Management Journal*, 21: 203-215.
- Guerrieri, P. (1998) "Trade Patterns, FDI, and Industrial Restructuring of Central and Eastern Europe", *BRIE Working Paper* 124.
- Günther, J. (2005) "Technology Spillovers from Foreign Investors in Transition Economies – Are the effects still expected?", *Economic and Business Review for Central and South - Eastern Europe*; 7(1): 5-24.
- Hägg, I. and J. Johanson (1983) *Firms in Networks: A New Perspective on Competitive Power*, Business and Social Research Institute (SNS), Uppsala.
- Hagedoorn, J. (2002) "Inter-firm R&D partnerships: an overview of major trends and patterns since 1960", *Research Policy*, 31(4): 477-492.
- (1993) "Understanding the rationale of strategic technology partnering: Inter-organizational modes of cooperation and sectoral differences", *Strategic Management Journal*, 14(5): 371-385.
- (1992) "Trends and patterns in strategic technology partnering since the early seventies", *Review of Industrial Organization*, 11: 601-616.
- Hagedoorn, J. and G. Duysters (2002) "The Effect of Mergers and Acquisitions on the Technological Performance of Companies in a High-tech Environment", *Technology Analysis & Strategic Management*, 14(1):67-85.
- Hagedoorn, J., A.N. Link, and N.S. Vonortas (2000) "Research partnerships", *Research Policy*, 29: 567-586.
- Hagedoorn, J. and Schakenraad, J. (1990) "Inter-Firm Partnerships and Co-operative

- Strategies in Core Technologies”, Freeman, C. and Soete, L. (eds.) *New Explorations in the Economics of Technical Change*, London, Pinter, 3-37
- Hagedoorn, J. and J. B. Sedaitis (1998) “Partnerships in Transition Economies: Technology Alliances in Russia”, *Research Policy*, 27: 177-85.
- Håkansson, H. (1990a) “Technological collaboration in industrial networks”, *European Management Journal*, Vol 8, No.3, pp.371-9.
- (1990b) “Product development in networks”, in D. Ford (ed.), *Understanding Business Markets: Interaction, Relationships and Networks*, the Industrial Marketing and Purchasing Group, London, Harcourt Brace & Co. Academic Press Ltd.
- (1989) *Corporate Technological Behaviour. Cooperation and Networks*, London: Routledge.
- (ed.) (1987) *Industrial Technological Development. A Network Approach*, London: Croom Helm.
- Håkansson, H., V. Havila and A-C.Pedersen (1999) ‘Learning in Networks’, *Industrial Marketing Management*, 28: 443-452.
- Håkansson H and A. Lundgren (1995) “Industrial Networks and Technological Innovation”, in Möller, K. and Wilson, D. (eds.), *Business Marketing: An Interaction and Network Perspective*, Dordrecht, Kluwer Academic Publishers, 291-320.
- Håkansson, H. and J. Johanson (1988) “Formal and Informal Cooperation Strategies in International Industrial Networks”, in F. J Contractor and P. Lorange (eds.), *Cooperative Strategies in International Business. Joint Ventures and Technological Partnerships between Firms*, Lexington: Lexington Books, KY, 369-79.
- Hamel, G. (1991) “Competition for competence and inter-partner learning within international strategic alliances”, *Strategic Management Journal*, 12: 83-103.
- Hamel, G. and Prahalad, C.K. (1988) “Creating Global Strategic Capability”, in N. Hood and J.E. Vahlne (eds.), *Strategies in global competition*, London, Croom Helm, 5-39.
- Hamel, G., Doz, Y. and Prahalad, C. (1989) “Collaborate with your competitors and win”, *Harvard Business Review*, January-February: 133-139
- Hamfelt, C. and A-K. Lindberg (1987) “Technological Development and the Individual’s Contact Network”, in Håkansson, H., (ed.), *Industrial Technological Development. A Network Approach*, London: Croom Helm, 177-209.
- Hamilton, G.G. and R.C. Feenstra (1998) “Varieties of Hierarchies and Markets: An Introduction”, in G. Dosi, D.J. Teece and J. Chytry (eds), *Technology, Organisation and Competitiveness Perspectives on Industrial and Corporate Change*, Oxford: Oxford University Press.
- Hansen, M.T. (2002) “Knowledge networks: Explaining effective knowledge sharing in multiunit companies”, *Organization Science*, 13(3): 232-248.
- (1999) “The Search-Transfer Problem: The role of weak ties in sharing knowledge across organization subunits”, *Administrative Science Quarterly*, 44: 82-111.
- Hanson, P. and K. Pavitt (1987) *The Comparative Economics of Research, Development and Innovation in east and West: A Survey*, Chur. Harwood Academic Publishers.
- Hanzl, D. (2000) *Development and Prospects of the Food-processing Products, Beverages and Tobacco Sector in the Central and Eastern European Countries*, WIIW Industry Studies, 2000/3.
- Hatzichronoglou, T. (1997) “Revision of the high-technology sector and product Classification”, *STI Working Paper*, OECD/GD (97) 216.
- Haudeville, B., M. Dabic, M. Gorynia (2002) “National Differences in Technology

- Transfers in East European Transition Economies”, *Mondes en Développement*, 2002/4 No 120, p. 75-85. Doi : 10.3917/Med.120.0075; accessed 17 June 2011.
<http://www.cairn.info/revue-mondes-en-developpement-2002-4-page-75.htm>
- Haug, D. (1992) “The International Transfer of Technology: Lessons That East Europe Can Learn From The Failed Third World Experience”, *Harvard Journal of Law & Technology*, Volume 5, Spring Issue, 1992, pp.209-240, available at
http://jolt.law.harvard.edu/articles/pdf/v05/05_2HarvJLTech209.pdf, accessed 17 June 2011.
- Hayden, E. (1976) *Technology Transfer to East Europe: U.S. Corporate Experience*. New York: Praeger.
- Heide, J. B. (1994) “Interorganizational governance in marketing channels”, *Journal of Marketing*, 58 (1): 71-85.
- Heide, J.B. and A.S. Miner (1992) “The shadow of the future: effects of anticipated interaction and frequency of contact on buyer–seller cooperation”, *Academy of Management Journal*, 35: 265-291.
- Heidenreich, M. (2009) “Innovation patterns and location of European low- and medium technology industries”, *Research Policy*, 28: 483-494.
- Henderson, J., P. Dicken, M. Hess, N.M. Coe, and H. W-C Yeung (2002) ‘Global production networks and the analysis of economic development’, *Review of International Political Economy*, 9: 436–464.
- Henscher, D. and L.W. Johnson (1981) *Applied Discrete Choice Modelling*, London: Croom Helm.
- Henriot, A. and A. Inotai (1998) “What Future for the Integration of the European Union and the Central and Eastern European Countries?”, *BRIE Working Paper* 127.
- Hess, M. (2008) “Governance, value chains and networks: an afterword”, *Economy and Society*, 37 (3): 452-459.
- Hess, M. and Wai-Chung Yeung H. (2006) ‘Whither global production networks in economic geography?’, *Environment and Planning A*, 38: 1193-1204.
- Hirsch-Kreinsen, H. (2008) “‘Low-Tech’ Innovations”, *Industry and Innovation*, 15(1):19-43.
- Hirsch-Kreinsen, H., D. Jacobson, S. Laestadius and K. Smith (2003) “Low-Tech Industries and the Knowledge Economy: State of the Art and Research Challenges”, paper written within the context of the research project “PILOT: Policy and Innovation in Low-Tech”.
- Hirschman, A.O. (1970) *Exit, Voice and Loyalty*, Cambridge, MA: Harvard University Press.
- (1958) *Strategy of Economic Development*, Yale University Press, New Haven.
- Hite, J.M. and W. S. Hesterly (2001) ‘The Evolution of Firm Networks: From Emergence of Early Growth of the Firm’, *Strategic Management Journal*, 22: 275-286.
- Hobday, M. (2003) “Innovation in Asian Industrialization: A Gerschenkronian Perspective”, *Oxford Development Studies*, 31(3): 293-314.
- (1998) “Latecomer Catch-up Strategies in Electronics: Samsung of Korea and ACER of Taiwan”, *Asia Pacific Business Review*, 4(2/3): 48-83.
- (1995a) *Innovation in East Asia: The Challenge to Japan*, Edward Elgar, Cheltenham, UK.
- (1995b) “The Latecomer Firm”, in M. Hobday, *Innovation in East Asia: The Challenge to Japan*, Edward Elgar, Cheltenham, UK, Chapter 3: 32-50.

- (1995c) "East Asian Latecomer Firms: Learning the Technology of Electronics, *World Development*, 23(7): 1171-1193.
- (1994) "The Limits of Silicon Valley: A critique of Network Theory", *Technology Analysis and Strategic Management*, 6(2): 231-244.
- Hobday, M., H. Rush and J. Bessant (2004) "Approaching the innovation frontier in Korea: the transition phase to leadership", *Research Policy*, 33(10):1433-1457.
- Hopkins, T.K. and I. Wallerstein (1986) "Commodity chains in the world economy prior to 1800", *Review*, 10(1): 157-170.
- Hoppe, M. 2005. Technology Transfer through Trade. *Nota di Lavoro* 19.2005. Fondazione Eni Enrico Mattei, Milano.
- Hosmer, D.W. and S. Lemeshow (2000) *Applied Logistic Regression*, second edition, Wiley-Interscience, Canada.
- Hsing, Y.-T. (1999) "Trading companies in Taiwan's fashion shoe networks", *Journal of International Economics*, 48: 101-120.
- Huber, G.P. (1991) "Organizational learning: the contributing processes and the literatures", *Organization Science*, 2(1): 88-116.
- Humphrey, J. (2001) "Opportunities for SMEs in Developing Countries to Upgrade in a Global Economy", paper written for the ILO's In Focus Programme on Small Enterprise Development (IFP-SEED), to be published in 2002 as a SEED Working Paper.
- Humphrey, J. and H. Schmitz (2008) "Inter-firm relationships in global value chains: trends in chain governance and their policy implications", *International Journal of Technological Learning, Innovation and Development*, 1(3):258-282.
- (2004a) 'Governance in global value chains', in H. Schmitz (ed.) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK, 95-109.
- (2004b) 'Chain governance and upgrading: taking stock', in H. Schmitz (ed.) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK, 349-381.
- (2002) "How does insertion in global value chains affect upgrading industrial clusters?", *Regional Studies*, 36(9), 1017-1027.
- (2001) "Governance in global value chains", *IDS Bulletin*, 32 (3): 19-29.
- (2000) "Governance and Upgrading: Linking Industrial Cluster and Global Value Chain Research", IDS Working Paper 120, Brighton, IDS, University of Sussex.
- IMF (1997) "Republic of Poland-Recent Economic Developments", *IMF Staff Country Report* No. 97/33, April 1997, International Monetary Fund, Washington D.C..
- Inkpen, A. (1998) "Learning, Knowledge Acquisition and Strategic Alliances", *European Management Journal*, 16(2): 223-229.
- Inzelt, A. (2008) "The inflow of highly skilled workers into Hungary: A by-product of FDI", *Journal of Technology Transfer*, 33(4):422-438.
- Jarillo, J. C. (1988) 'On strategic networks', *Strategic Management Journal*, 9(1): 31-41.
- Jasinski, A.H. (2003) "Has innovation policy an influence on innovation? The case of a country in transition", *Science and Public Policy*, 30(6): 431-440.
- (2000) "Technology Transfer in Poland: A poor state of affairs and a wavering policy", *Science and Public Policy*, 27(4): 235-240.
- (1997) "Academy-Industry relations for Innovation in Poland", *STEEP Discussion Paper* No. 41, SPRU, University of Sussex, Brighton.
- Jensen, C. (2004) "Localized Spillovers in the Polish Food-processing Industry: The

- Role of FDI in the Development Process?", *Regional Studies*, 38(5): 535–550.
- Jensen, M.B., R. Johnson, E. Lorenz, B.A. Lundvall (2007) "Forms of knowledge and modes of innovation", *Research Policy* 36: 680–693.
- Johanson, J. and L-G. Mattson (1987) "Interorganizational Relations in Industrial Systems: A Network Approach Compared with the Transaction-Cost Approach", *International Studies of Management and Organization*, XVII(1):34–48.
- Johanson, J., & Vahlne, J. -E. (1977) "The internationalization process of the firm- A model of knowledge development and increasing foreign market commitments", *Journal of International Business Studies*, 8: 23–32.
- Johnson, B. (1992) "Institutional Learning", in Lundvall, B.-Å. (ed.) *National Systems of Innovation*, London, Pinter Publishers, 23–44.
- Kaiser, U. (2002) "Measuring knowledge spillovers in manufacturing and services: an empirical assessment of alternative approaches", *Research Policy*, 31:125–144.
- Kalantaridis, C., S. Slava and I. Vassilev (2008) "Global networks and the reorganization of production in the clothing industry of pos-socialist Ukraine", *Global Networks*, 8(3): 308–328.
- Kaminski, B. (1993) "Foreign Trade Dimension of the Market Transition in Poland: The Surprising Export Performance and its Sustainability", International Economics Department, The World Bank, *Policy Research Working Papers*, WPS 1144.
- Kapelko, M. (2006) "Evaluating Efficiency in the Framework of Resource-Based View of the Firm. Evidence from Polish and Spanish Textile and Clothing Industry", Universitat Autònoma de Barcelona, Research Work, (accessed 12 October 2011) <http://idem.uab.es/treballs%20recerca/Magdalena%20Kapelko.pdf>
- Kaplinsky, R. (2000) "Spreading the gains from globalisation. What can be learnt from value chain analysis?", *IDS Working Paper* 110, Brighton, IDS, University of Sussex.
- (1998) "Globalisation, industrialisation and sustainable growth: The pursuit of the nth rent", *Discussion paper* 365, Brighton, IDS, University of Sussex.
- Kaplinsky, R., Memedovic, O., Morris, M., Readman, J. (2003) "The Global Wood Furniture Value Chain: What Prospects for Upgrading by Developing Countries – The Case Of South Africa", *UNIDO Sectoral Studies Series*, Vienna.
- Kaplinsky, R., Morris, M., & Readman, J. (2002) "The globalisation of product markets and immiserising growth: Lessons from the South African furniture industry", *World Development*, 30(7): 1159–1177.
- Kaplinsky, R. and J. Readman (2001), "How Can SME Producers Serve Global Markets and Sustain Income Growth?", *Institute of Development Studies Papers*, University of Sussex, <http://www.ids.ac.uk/ids/global/valchn.html>.
- (2000) "Globalisation and Upgrading: What Can (And Cannot) Be Learnt From International Trade Statistics In The Wood Furniture Sector?", Brighton: IDS, University of Sussex, www.ids.ac.uk/ids/global/valchn.html
- Kaplinsky, R. and Hoffman, K. (1992) *TNCs and the Transfer of New Management Practices to Developing Countries*, Report prepared for UNCTNC, October, mimeo.
- Katz, J. (ed.) (1987) *Technology Generation in Latin American Manufacturing Industries*, New York: St Martin's Press.
- Kay, N.M. (1999) *The Boundaries of the Firm, Critiques, Strategies and Policies*, London: Macmillan Press.
- Kessler, J. (1999) "The North American Free Trade Agreement, emerging apparel production networks and industrial upgrading: the southern California/ Mexico connection", *Review of International Political Economy*, 6(4): 565–608.
- Kim, L. (2001) "Knowledge Management: A new Perspective for Development

- Strategy”, *East-West Center Working Papers, Economic Series*, No. 12.
- (1999a), *Learning and Innovation in Economic Development*, Cheltenham: Edward Elgar.
 - (1999b) “Building technological capability for industrialisation: Analytical frameworks and Korea’s experience”, *Industrial and Corporate Change*, 8(1): 111-136.
 - (1998a) “Crisis construction and Organizational Learning: Capability Building in Catching-up at Hyundai Motor”, *Organization Science*, 9(4): 506-21.
 - (1998b) “Technology Policies and Strategies for Developing countries: Lessons from the Korean Experience”, *Technology Analysis and Strategic Management*, 10(3):311-323.
 - (1997) *Imitation to Innovation: The Dynamics of Korea's Technological Learning*, Boston, Harvard Business School Press.
 - (1993) “National System of Industrial Innovation: Dynamics of Capability Building in Korea”, in R. Nelson (ed.) *National Innovation Systems: A Comparative Study*, Oxford University Press, Oxford.
 - (1980) “Stages of Development of Industrial Technology in a Developing Country: A Model”, *Research Policy*, 9(3): 254-77.
- Kim, C-S. and A. C. Inkpen (2005) “Cross-border R&D alliances, absorptive capacity and technology learning” *Journal of International Management*, 11: 313-329.
- Kim, S.R. and N. von Tunzelmann (1998) “Aligning Internal and External Networks: Taiwan’s Specialization in IT”, *SEWPS paper* no. 17, SPRU, University of Sussex.
- Kishimoto, C. (2004) “Clustering and upgrading in the global value chains: The Taiwanese personal computer industry” in H. Schmitz (ed.) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK, pp.233-264.
- Kochanowicz, J., P.Kozarzewski, and R. Woodward (2005) “Understanding Reform: The case of Poland”, *CASE reports* No. 59/2005, CASE, Warsaw.
- Kogut, B. (2000) “Network As Knowledge: Generative Rules and The Emergence of Structure”, *Strategic Management Journal*, 21: 405–425.
- Kogut, B. and U. Zander (1993) “Knowledge of the firm and the evolutionary theory of the multinational corporation”, *Journal of International Business Studies*, 24: 625-645.
- (1992) “Knowledge of the firm, combinative capabilities, and the replication of technology”, *Organization Science*, 3: 383–397.
- Kogut, B., W. Shan and G. Walker (1993) “Knowledge in the network and the network as knowledge: the structuring of new industries”, in Grabher, G. (ed) 1993, *The Embedded Firm. On the Socioeconomics of industrial networks*, London: Routledge, pp.67-94.
- (1992) “The Make-or-Cooperate Decision in the context of an Industry Network”, in N. Nohria and R.G. Eccles, (eds.), *Networks and Organizations*, Harvard Business School Press.
- Kojima, K. (2000) “The ‘Flying Geese’ Model of Asian Economic Development: Origin, Theoretical Extensions and Regional Policy Implications”, *Journal of Asian Economics*, 11:375-401.
- Kołodko, G.W. (2005) “Institutions, Policies, and Growth”, in G.W. Kolodko (ed), *The Polish Miracle: Lessons for the Emerging Markets*, (Transition and Development) Ashgate Publishing Limited, Aldershot, England, pp.3-26.
- Kornai, J. (1995) “Transformational Recession: A General Phenomenon Examined

- through the Example of Hungary's Development", in J. Kornai, *Highways and Byways: Studies on Reform and Post-communist Transition*, MIT Press, Cambridge.
- Kostecka, E. (1998) "The Polish Apparel Industry", US & Foreign Commercial Service and US Department of State,
<http://www.mac.doc/eebic/countryr/poland/market/apparel.htm>
- Kozarzewski, P. and R. Woodward (2006) "The Reform Process in Post-Communist Transition: Understanding Reform in Eastern and Central Europe and the Commonwealth of Independent States" in J.M. Fanelli and G. McMahon (eds.) *Understanding Market Reforms Volume 2: Motivation, Implementation and Sustainability*, Palgrave Macmillan, New York, pp.141-192.
- Kozłowski, J. (1998), 'Institutional Transformation of STS in Poland', in W. Meske *et al.* (eds.) *Transforming Science and Technology Systems – the Endless Transition*, IOS Press.
- (2004) "Poland: Restructuring S&T without radical transformation", in W. Meske (ed.), *From system transformation to European integration. Science and technology in Central and Eastern Europe at the beginning of 21st century*, LIT Verlag Muenster, pp.185-196.
- Kurz, C. and V. Wittke (1998) "Using Industrial Capacities as a Way of Integrating Central-East European Economies", *BRIE Working Paper* 123.
- Lall, S. (2000) "The technological structure and performance of developing country manufactured exports, 1985-98", *Oxford Development Studies*, 28(3): 337-369.
- (1992) "Technological Capabilities and Industrialization", *World Development*, 20(2): 165-186.
- Lane, P.J. and M. Lubatkin (1998) "Relative Absorptive Capacity and Interorganizational Learning", *Strategic Management Journal*, 19(5): 461-477.
- Langlois, R.N. (1992), "Transaction-cost economics in real time", *Industrial and Corporate Change*, 1(1): 99-127.
- Lee, J., Z.T. Bae and D.K. Choi (1988) "Technology development processes: a model for a developing country with a global perspective", *R&D Management* 18 (3):235-250.
- Lee, J.-R. and J.-S. Chen (2000) "Dynamic synergy creation with multiple business activities: toward a competence-based growth model for contract manufacturers" in R. Sanchez and A. Heene (eds) *The Development for Competence-based management, Advances in applied business strategy*, Stanford, CT:JAI press, 209-228.
- Leiponen, A., 2002, 'Why Do Firms Not Collaborate? The Role of Competencies and Technological Regimes', in A. Kleinknecht and P. Mohnen (eds.), *Innovation and Firm Performance: Econometric Explorations of Survey Data*, London: Palgrave.
- Levitt, B. and J.G. March (1988) "Organizational Learning", *Annual Review of Sociology*, 14: 319-338.
- Linden, G. (1998) "Building Production Networks in Central Europe: The Case of the Electronics Industry", *BRIE Working Paper* 126.
- Lorange, P. and J. Roos (1993) *Strategic Alliances. Formation, Implementation and Evolution*, Massachusetts: Blackwell Business.
- Lu, Y. and F. Burton (1998) "Reflections on Theoretical Perspectives of International Strategic Alliances", in P.J. Buckley, F. Burton, and H. Mirza (eds.), *The Strategy and Organization of International Business*, London, MacMillan Press Ltd., pp.149-172.
- Lundvall, B.-Å (2001) "Innovation policy in the Globalizing Learning Economy", in D. Archibugi and B.-Å. Lundvall (eds.), *The Globalizing Learning Economy*, Oxford,

- Oxford University Press, pp.273-291.
- (1996) "The Social Dimension of the Learning Economy", *DRUID Discussion Paper*, No. 96-1.
 - (ed.) (1992a) *National Systems of Innovation – Towards a Theory of Innovation and Interactive Learning*, London, Pinter Publishers.
 - (1992b) "Introduction", in Lundvall, B.-Å. (ed.) *National Systems of Innovation*, London, Pinter Publishers, 1-19.
 - (1992c) "User-Producer Relationships, National Systems of Innovation and Internalisation", in Lundvall, B.-Å. (ed.) *National Systems of Innovation*, London, Pinter Publishers, 45-67.
 - (1988) "Innovation as an interactive process: from user-producer interaction to the national systems of innovation", in G. Dosi, C. Freeman, R. Nelson, G. Silverberg, and L. Soete (eds) : *Technical change and economic theory*, Pinters Publishers, London and New-York, pp. 349-369.
- Lyles, M. (1988) "Learning among joint venture sophisticated firms", in F.J. Contractor and P. Lorange (eds), *Cooperative Strategies in International Business*, Lexington Books, Lexington, MA, pp.301-316.
- Madhavan, R., B. R. Koka, J. E. Prescott (1998) "Networks in transition: How industry events (re)shape interfirm relationship", *Strategic Management Journal*, 19(5): 439-459.
- Madhok, A. (2000) "Inter-firm Collaboration: Contractual and Capabilities-Based Perspectives", in N. Foss and V. Mahnke, (eds.), *Competence, Governance, and Entrepreneurship. Advances in Economic Strategy Research*, Oxford, Oxford University Press, pp.276-303.
- Makhija, M.V. and U. Ganesh (1997) "The relationship between control and partner learning in learning-related joint ventures", *Organization Science* 8 (5): 508–527.
- Malerba, F. (2005) "Sectoral Systems: How and Why Innovation Differs across Sectors", in Fagerberg, J., Mowery, D. and Nelson, R. (eds.) *The Oxford Handbook of Innovation*, Oxford, Oxford University Press, 380-406.
- (2002) "Sectoral Systems of Innovation and Production", *Research Policy*, 31: 247-264.
 - (1992) "Learning by firms and incremental technical change", *The Economic Journal*, (102): 845-859.
- Mariti, P. and R.H. Smiley (1983) "Co-operative Agreements and the Organization of Industry", *The Journal of Industrial Economics*, 31 (4): 437-51.
- Mason, G., J.-P. Beltramo, and J.-J. Paul (2004) 'External knowledge sourcing in different national settings: a comparison of electronics establishments in Britain and France', *Research Policy*, 33: 53–72.
- McDermott, G.A. and R.A. Corredoira (2010) "Network composition, collaborative ties, and upgrading in emerging-market firms: Lessons from the Argentine autoparts sector", *Journal of International Business Studies*, 41: 308–329.
- Meyer-Stamer, J. (2004) "Paradoxes and ironies of locational policy in the new global economy", in H. Schmitz (ed.) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK, pp.327-348.
- Michalet, C-A. (1991) "Strategic partnership and the changing internationalization process", in L. K. Mytelka (ed.), *Strategic Partnerships, States, Firms and International Competition*, London, Pinter Publishers.
- Miyazaki, K. (1995) 'The concept of competence building', in K. Miyazaki, *Building*

- Competences in the Firm. Lessons from Japanese and European Optoelectronics*, St. Martin's Press, pp.11-38.
- Mowery, D. (1998) "Collaborative R&D: How Effective is it?", *Issues in Science and Technology*, Fall 1998, accessed 30.06.2003, <http://www.nap.edu/issues/15.1/mowery.htm>
- , J. E. Oxley and B. S. Silverman (1996) "Strategic alliances and interfirm knowledge transfer", *Strategic Management Journal*, 17:77-91.
- and J.E. Oxley (1995) "Inward Technology Transfer and Competitiveness: The Role of National Innovation Systems", *Cambridge Journal of Economics*, 19 (1):67-93.
- Möller, K. and Wilson, D. (1995) "Interaction and Network Approach to Business Marketing: A Review and Evaluation", in Möller, K. and Wilson, D. (eds.) *Business Marketing: An Interaction and Network Perspective*, Dordrecht, Kluwer Academic Publishers, 587-613.
- Murray, F. (2002) "Innovation as co-evolution of scientific and technological networks: exploring tissue engineering", *Research Policy*, 31: 1389-1403.
- Mylonas, P. (1994) "Integration into the World Economy", in Ebril, L.P. *et al.*, *Poland: The Path to a Market Economy*, IMF, Occasional Paper No. 113, WashingtonD.C..
- Mytelka, L.K. (2001) "Mergers, Acquisitions, and Inter-firm Technology Agreements in the Global Learning Economy", in D. Archibugi and B-A. Lundvall (eds.), *The Globalizing Learning Economy*, Oxford, OxfordUniversity Press.
- Mytelka, L.K. (1991) "Crisis, technological change and the strategic alliance", in L.K.Mytelka (ed.), *Strategic Partnerships, States, Firms and International Competition*, London, Pinter Publishers.
- Nadvi, K. (2004) "Effect of Global Standards on Local Producers: A Pakistani case study", in H. Schmitz, ed., *Local Enterprises in the Global Economy: Issues of Governance and Upgrading*, Edward Elgar Press, pp.297-325.
- Narula, R. (1996) "Forms of international cooperation between corporations", in J. Jepma and A. P. Rhoen (eds), *International Trade: A Business Perspective*, Longman, Harlow, pp.98-122.
- and B. Sadowski (2002) "Technological catch-up and strategic technology partnering in developing countries", *International Journal of Technological Management*, 23(6).
- Navas-Aleman, L. (2011) "The Impact of Operating in Multiple Value Chains for Upgrading: The Case of the Brazilian Furniture and Footwear Industries", *World Development* 38(4):1386-1397.
- (2006) "Opportunities and obstacles for industrial upgrading of Brazilian footwear and furniture firms: a comparison of global and national value chains", Unpublished PhD thesis, Brighton, IDS, University of Sussex.
- Nelson, R. (1991) "Why do firms differ, and how does it matter?", *Strategic Management Journal*, 12: 61-74.
- and Rosenberg, N. (1993) "Technical Innovation and National Systems", in Nelson, R. (Ed.) *National Innovation Systems*, Oxford, Oxford University Press, 3-21.
- and S. G. Winter (1982) *An evolutionary theory of economic change*, Cambridge Massachusetts, Harvard University Press.
- (1977) "In search of useful theory of innovation", *Research Policy*, 6(1): 36-76.
- Nicholas, F. (1996) "Combined roles of process and product innovation in the food industries", in G. Galizzi and L. Venturini (eds.), *Economics of Innovation: The Case of Food-processing Industry*, Physica-Verlag Heidelberg, pp. 341-354.

- Nohria, N., and S. Ghoshal (1997) *The differentiated network: A new model for organizing multinational corporations*, San Francisco: Jossey-Bass.
- and C. Garcia-Pont (1991) "Global strategic linkages and industry structure", *Strategic Management Journal*, 12: 105-124.
- Nonaka, I. (1994) "A Dynamic Theory of Organizational Knowledge", *Organization Science*, 5: 14-37.
- Noorderhaven, N. and A.-W. Harzing (2009) "Knowledge-sharing and social interaction within MNEs", *Journal of International Business Studies*, 40(5): 719-741.
- O'Donnell, S. and T. Blumentritt (1999) "The contribution of foreign subsidiaries to host country national competitiveness", *Journal of International Management*, 5:187-206.
- OECD (2008) *OECD Economic Surveys: Poland, 2008*, Vol 2008/10, OECD, Paris, June 2008.
- (2007) "Policy Mix for Innovation In Poland - Key Issues and Recommendations", Report prepared by OECD on the request made by Ministry for Science and Higher Education and Ministry of Economy, Warsaw, (accessed 29/04/2010) <http://www.oecd.org/dataoecd/58/39/44960775.pdf>.
- (2006) *OECD Economic Surveys: Poland, 2006*, OECD, Paris, 2006.
- (2004) *OECD Science, Technology And Industry Outlook 2004 Policy Questionnaire* 10-12 December 2004, OECD Headquarters, Paris, by Directorate For Science, Technology And Industry Committee For Scientific And Technological Policy, (accessed 29/04/2010) <http://www.oecd.org/dataoecd/30/24/34243480.pdf>
- (2004) "General Overview of Science, Technology And Innovation Policies Implemented in Poland and Major Changes In 2002-2003", *OECD Science, Technology and Industry Outlook 2004 Country Response To Policy Questionnaire*, (accessed 29/04/2010) <http://www.oecd.org/dataoecd/30/13/34243138.pdf>.
- (2000) *OECD Economic Surveys: Poland, 1999-2000*, OECD, Paris 2000.
- (1998a) *OECD Economic Surveys: Poland, 1997-1998*, OECD, Paris, 1998.
- (1998b) "Impediments to Efficiency in the Agro-food-processing Chain in Bulgaria, Romania and Slovenia", *Agricultural Policy Paper* No. 1998-02, OECD, Paris, 1998.
- (1997) *OECD Economic Surveys: Poland, 1996-1997*, OECD, Paris, 1997.
- Ornaghi, C. 2004. From Innovation to Productivity. Ph. D. Dissertation. Universidad Carlos III de Madrid, Departamento de Economia, Madrid.
- Owen-Smith, J. and Powell, W.W. (2004) "Knowledge networks as channels and conduits: The effects of spillovers in the Boston biotechnology community", *Organization Science*, 15(1): 5-21.
- Özatağan, G. (2011) "Dynamics of Value Chain Governance: Increasing Supplier Competence and Changing Power Relations in the Periphery of Automotive Production—Evidence from Bursa, Turkey", *European Planning Studies*, 19(1):77-95.
- PACE Questionnaire Study, Policies, Appropriability and Competitiveness for European Enterprises, A Research Study by MERIT for the SPRINT Programme of the European Enterprises.
- PAIZ (2003) The list of the largest foreign investors in Poland, December 2003, Polish Agency for Foreign Investment, Warsaw.
- (2001) *The Polish Food-processing Industry*, Polish Agency for Foreign Investment, Warsaw.
- Pak, C.K., Snell, R.S. (2003) "Programmed, autonomous-formal and spontaneous

- organizational learning”, *British Journal of Management* 14: 275–288.
- Palpacuer, F. (2000) “Competence-based Strategies and Global Production Networks. A Discussion of Current changes and Its Implications for Employment”, *Competition and Change*, 4: 353–400.
- and S. Tozanli (2008) “Changing governance patterns in European food-processing chains: the rise of a new divide between global players and regional producers”, *Transnational Corporations*, 17(1):69–98.
- Pavitt, K. (1997) “Transforming centrally planned systems of science and technology: the problem of obsolete competencies”, in D. A. Dyker (ed), *The Technology of Transition. Science and Technology Policies for Transition Countries*, Central European University Press, Budapest, pp.43–62.
- (1984) “Patterns of technical change: Towards a taxonomy and a theory”, *Research Policy* 13:343–374.
- Pellegrin J. (2001) “‘Learning by interacting’ and catching up in Central and Eastern European countries: evidence from outward processing traffic”, *Journal of International Relations and Development*, 4(3): 250– 273.
- (2000) “German production networks in Central/Eastern Europe: Competitive Breakthroughs and Old Ghosts”, in J. Lorentzen (ed.), *Globalization in Emerging Markets*, Macmillan: Basingstoke.
- Peng, M.W., D.Y.L. Wang, and Y. Jiang (2008) “An institution-based view of international business strategy: a focus on emerging economies”, *Journal of International Business Studies*, 39: 920–936.
- Penrose, E. (1959) *The Theory of the Growth of the Firm*, Oxford, Basil Blackwell.
- Petrucci, C.J. (2009) “A primer for social worker researchers on how to conduct a multinomial logistic regression”, *Journal of Social Science Research*, 35: 193–205.
- Pfeffer, J. and P. Nowak (1976) “Joint Ventures and interorganizational interdependence”, *Administrative Science Quarterly*, 211: 398–418.
- Pickles, J. and A. Smith (2011) “Delocalization and Persistence in the European Clothing Industry: The Reconfiguration of Trade and Production Networks”, *Regional Studies*, 45(2): 167–185.
- , A. Smith, M. Bucek, P. Roukova, and R. Begg (2006) “Upgrading, changing competitive pressures, and diverse practices in the East and Central European apparel industry”, *Environment and Planning A*, 38: 2305–2324.
- Pietrobelli, C., and R. Rabellotti (2011) “Global Value Chains Meet Innovation Systems: Are There Learning Opportunities for Developing Countries?”, *World Development*, 39(7): 1261–1269.
- (2004), ‘Upgrading in clusters and value chains in Latin America: The role of policies’, in *Sustainable Development Department Best Practices Series*, Washington, DC: Inter American Development Bank.
- Pinto, B., M. Belka, and S. Krajewski (1992) “Microeconomics of Transformation in Poland: A survey of State Enterprise Responses”, *Policy Research Working Paper* WPS 982, Country Economics Department The World Bank, Washington.
- Polanyi, M. (1967) “Tacit knowing” in M. Polanyi (ed.) *The tacit dimension*, London : Routledge & K. Paul, pp. 3–25.
- Ponte, S. and J. Ewert (2009) “Which way is ‘up’ in Upgrading? Trajectories of Change in the Value Chain for South African Wine”, *World Development*, 37(10):1637–1650.
- Porter, M. (1990) *The competitive advantage of nations*, London and Basingstoke: MacMillan.
- Powell, W. W. (1990) “Neither market nor hierarchy: Network forms of organization”,

- in L. L. Cummings and B. M. Staw (eds.), *Research in Organizational Behavior*, 12: 295–336, Greenwich, CT: JAI Press.
- and S. Grodal (2005) “Networks of Innovators”, in J. Fagerberg, D.C. Mowery and R.R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford, Oxford University Press, pp.56-85.
- , D. R. White, K.W. Koput, J. Owen-Smith (2005) “Network Dynamics and Field Evolution: The Growth of Interorganizational Collaboration in the Life Sciences”, *American Journal of Sociology*, 110:4, 1132-1205.
- and P. Brantley (1992). ‘Competitive cooperation in biotechnology: Learning through networks’. In N. Nohria and R. Eccles (eds.), *Networks and Organizations: Structure, Form and Action*. Harvard Business School Press, Boston, MA, pp. 366–394.
- , K. Koput and L. Smith-Doerr (1996). ‘Interorganizational collaboration and the locus of innovation: Networks of learning in biotechnology’, *Administrative Science Quarterly*, 41(1), pp. 116–145.
- Prahalad, C. and G. Hamel (1990) “The core competences of the corporation”, *Harvard Business Review*, May-June, pp.79-91.
- Pyka, A. (1997), “Informal networking”, *Technovation*, 17(4):207-220.
- Quadros, R. (2004) “Global Quality Standards and Technological Upgrading in the Brazilian Auto-Components Industry”, in H.Schmitz, ed., *Local Enterprises in the Global Economy: Issues of Governance and Upgrading*, Edward Elgar Press, pp.265-296.
- Rabellotti, R. (2004) “How globalization affects Italian industrial districts: the case of Brenta”, in H.Schmitz (ed.) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK, pp.140-173.
- Ramaswamy, K.V. and G. Gereffi (2000) “India’s Apparel Exports: The Challenge of Global Markets”, *The Developing Economies*, XXXVIII-2: 180-210.
- Radošević, S. (2004) “What Future for Science and Technology in Central and Eastern Europe in the 21st Century?”, in Meske, W., (ed.) *From System Transformation to European Integration: Science and technology in Central and Eastern Europe at the beginning of the 21st century*, Soziologie: Forschung und Wissenschaft (7), LIT Verlag, Münster, Germany, pp. 443-478.
- (2002) “Regional Innovation Systems in Central and Eastern Europe: Determinants, Organizers and Alignments”, *Journal of Technology Transfer*, 27(1): 87-96.
- (1999a) *International technology Transfer and Catch-up in Economic Development*, Edward Elgar, Cheltenham.
- (1999 b) “Transformation of science and technology systems into systems of innovation in central and eastern Europe: the emerging patterns and determinants”, *Structural Change and Economic Dynamics*, 10: 277–320.
- (1999c) “Patterns of innovative activities in countries of Central and Eastern Europe: An analysis based on comparison of innovation surveys”, *SPRU Electronic Working Papers* No. 35, Brighton: University of Sussex.
- (1998) “National Systems of Innovation in Economies in Transition: Between Restructuring and Erosion”, *Industrial and Corporate Change*. 7(1):77-108.
- (1997) “Systems of innovation in transformation: from socialism to post-socialism”, in C. Edquist (ed), *Systems of innovation. Technologies, institutions and organizations*, Pinter, A Cassell Imprint.
- and D.E. Yoruk (2001) “Videoton: The Growth of Enterprise through

- Entrepreneurship and Network Alignment”, *Working Paper series in Economics and Business*, No.3, Centre for the Study of Economic and Social Change in Europe, SSEES, UCL.
- Rapacki, R. (2001) “Economic Performance 1989-1999 and prospects for the future”, in G. Blazycyca and R. Rapacki (eds), *Poland into the New Millenium*, Economies and Societies in Transition series, Edward Elgar: Cheltenham, UK.
- Rojec, M. and M. Knell, 2012, “Why is there so little evidence on knowledge spillovers from Foreign Direct Investment?”, mimeo.
- Rosenberg, N. (1982) “Learning by using”, in N. Rosenberg, *Inside the Black Box: Technology and Economics*, Cambridge, Cambridge University Press, pp.120-141.
- Rothwell, R. (1977) “The characteristics of successful innovators and technically progressive firms”, *R&D Management*, 7(3): 191-206.
- Rothwell, R. and P. Gardiner (1983) “The role of design in product and process change”, *Design studies*, 4(3): 161-169.
- Sabel, C.F. (1994) “Learning by Monitoring: The Institutions of Economic Monitoring”, in N. Smelser and R. Swedberg (eds.), *Handbook of Economic Sociology*, Princeton University Press-Sage, Princeton, pp. 137-165.
- Sachs, J., C. Zinnes And Y. Eilat, 2000, Patterns And Determinants Of Economic Reform In Transition Economies: 1990-1998”, Consulting Assistance On Economic Reform II, Discussion Paper 61.
- Saliola, F. and A. Zanfei (2009) “Multinational firms, global value chains and the organization of knowledge transfer”, *Research Policy*, 38: 369–381.
- Salter, A.J. (1999) *Faint Expectations: Science and Technology Policy in Ontario*, DPhil Thesis, SPRU, University of Sussex.
- Sanchez, R. and A. Heene (2004) *The New Strategic Management. Organization, Competition, and Competence*, John Wiley & Sons, Inc., New York.
- Santos Pereira, T. T. (2000) *Changing Places? The Extension of Research Groups Through European Research Collaborations*, DPhil Thesis, SPRU, University of Sussex.
- Saunders, C.T. (ed) (1977) *East-West Cooperation in Business: Inter-firm Studies*, Wien: Springer-Verlag.
- Saxenian, A. (2002) “Transnational Communities and the Evolution of Global Production Networks: The Cases of Taiwan, China and India”, *Industry and Innovation*, 9(3):183-202.
- Scanlan C.L. “Introduction to Nonparametric Statistics”, Professor, Departments of Interdisciplinary Studies and Cardiopulmonary Sciences, School of Health Related Professions, University of Medicine and Dentistry of New Jersey, (accessed August 2011), http://www.umdnj.edu/idswweb/idst6000/nonparametric_analysis.pdf
- Schaffer, M.E. (1992) “Poland”, in D. A. Dyker (ed), *The National Economies of Europe*, Longman, London and New York.
- Schein, E. (1985) *Organizational Culture and Leadership*, Jossey Bass, San Francisco, CA.
- Schmitz, H. (2006) “Learning and Earning in Global Garment and Footwear Chains”, *The European Journal of Development Research*, 18: 4, 546-571.
- (ed.) (2004) *Local Enterprises in the Global Economy. Issues of Governance and Upgrading*, Edward Elgar: Cheltenham, UK.
- (2003) “Clusters and chains: how inter-firm organization influences industrial upgrading”, in Cassiolato, J.E. (eds.), *Systems of Innovation and Development. Evidence from Brazil*, Cheltenham, Edward Elgar.

- (1999) "Global Competition and Local Cooperation: Success and Failure in the Sinos Valley, Brazil", *World Development*, 27(9): 1627-1650.
- (1998) "Responding to Global Competitive Pressure: Local Co-operation and Upgrading in the Sinos Valley, Brazil", IDS Working Paper 82, IDS, University of Sussex, Brighton, UK
- (1995) "Small Shoemakers and Fordist Giants: Tale of a Supercluster", *World Development*, 23(1): 9-28.
- and S. Strambach (2009) "The organisational decomposition of innovation and global distribution of innovative activities: insights and research agenda", *International Journal of Technological Learning, Innovation and Development*, 2(4): 231-249.
- and P. Knorringa (2000) "Learning from Global Buyers", *The Journal of Development Studies*, 37(2): 177-205.
- Senker, J. (1996) "National systems of innovation, organizational learning and industrial biotechnology", *Technovation*, 16(5): 219-229.
- and W. Faulkner (1996) "Networks, tacit knowledge and innovation", in R. Coombs, A. Richards, P.P. Saviotti, and V. Walsh (eds.), *Technological Collaboration*, London, Edward Elgar.
- Simonin, B.L. (2004) "An empirical investigation of the process of knowledge transfer in international strategic alliances", *Journal of International Business Studies*, 35: 407-427.
- (1999a) "Ambiguity and the Process of Knowledge Transfer in Strategic Alliances", *Strategic Management Journal*, 20(7): 595-623.
- (1999b) "Transfer of marketing know-how in international strategic alliances: An empirical investigation of the role and antecedents of knowledge ambiguity", *Journal of International Business Studies*, 30(3): 463-490.
- (1997) "The importance of collaborative know-how: an empirical test of the learning organization", *Academy of Management Journal*, 40(5): 1150-1174.
- Slay, B. (1994) *The Polish Economy. Crisis, Reform and Transformation*, Princeton University Press, Princeton New Jersey.
- Smidt, M. de and E. Wever (1990) "Firms: Strategy and Changing Environments", in M. de Smidt and E. Wever (eds.), *The Corporate Firm in Changing World Economy. Case Studies in the Geography of Enterprise*, London, Routledge, pp.1-20.
- Smith, A. (2003) "Power Relations, Industrial Clusters, and Regional Transformations: Pan-European Integration and Outward Processing in the Slovak Clothing Industry", *Economic Geography* 79(1): 17-40.
- , Pickles, J., Buček, M., Begg, B. and Roukova, P. (2008) "Reconfiguring "post-socialist" regions: trans-border networks and regional competition in the Slovak and Ukrainian clothing industry", *Global Networks*, 8 (3): 281-307.
- Spekman, E.S., and K.S. Celly (1995) "Towards an understanding of the antecedents of strategic alliances", in Möller, K. and Wilson, D. (eds.) *Business Marketing: An Interaction and Network Perspective*, Dordrecht, Kluwer Academic Publishers, 157-191.
- Stoeber, W.A. (1994) "The Role of Foreign Investment in Poland's Economic Restructuring", *Journal of East-West Business*, 1(1): 97-115.
- Strada, A., G. Morkis, J. Trafiałek and D. Kołożyn-Krajewska (2005) "Safety and Quality Assurance and Management Systems: Level of Implementation in Food-processing Enterprises in Poland", http://www.ip.aua.gr/Studies/Strada_etal.pdf (accessed 09 December 2009).
- Sturgeon, T. (2008) "Mapping integrative trade: conceptualizing and measuring global

- value chains, *International Journal of Technological Learning, Innovation and Development*, Vol. 1, No. 3:237-257.
- (2002) "Modular Production Networks: a new American model of industrial organization", *Industrial and Corporate Change*, 11(3): 451-496.
 - (2001) "How Do We Define Value Chains and Production Networks?", *IDS Bulletin*, 32(3): 9-18.
 - and G. Gereffi (2009) "Measuring success in the global economy: international trade, industrial upgrading, and business function outsourcing in global value chains, *Transnational Corporations*, 18(2): 1-36.
- Szalavetz, A. (1997) "Sailing before the wind of globalization. Corporate restructuring in Hungary", *IWE Working Paper* No. 78, Institute of World Economy April (No. 78).
- Szymanski, A., M. Gorton and L. Hubbard (2007) "A Comparative Analysis of Firm Performance in Post-socialist Economies: Evidence from the Polish Food Processing Industry", *Post-Communist Economies*, 19(4): 433-448.
- Tabachnick, B.G. and L.S. Fidell (2007) *Using Multivariate Statistics*, Fifth Edition, Boston: Pearson Education Inc..
- Tatikonda, M. V. and G. N. Stock (2003) "Product Technology Transfer in the Upstream Supply Chain", *Journal of Product Innovation Management*, 20:444-467.
- Teece, D.J. (1996) "Firm organization, industrial structure, and technological innovation", *Journal of Economic Behavior & Organization*, 31:193-224.
- Teece, D. (1977) "Technology transfer by multinational firms: the resource costs of transferring technological know-how", *The Economic Journal*, June, 87: 242-261.
- , G. Pisano and A. Shuen (1997) "Dynamic Capabilities and strategic Management", *Strategic Management Journal*, 18(7): 509-533.
 - and G. Pisano (1994) "Dynamic Capabilities: An Introduction", *Industrial and Corporate Change*, 4(3): 537-556.
- Terterov, M. and J. Reuvid (eds) (2005) *Doing Business with Poland*, PAIZ, Poland.
- Thompson, G., Fances, J., Levacic, R., and Mitchell, J. (1991) *Markets, Hierarchies and Networks. The Coordination of Social Life*, London: Sage Publications, The Open University.
- Thorelli, H.B. (1986) "Networks: Between markets and hierarchies", *Strategic Management Journal*, 7: 37-51.
- Tokatli, N. (2007) "Asymmetrical power relations and upgrading among suppliers of – global clothing brands: Hugo Boss in Turkey", *Journal of Economic Geography*, 7: 67-92.
- and Ö. Kizilgün (2004) "Upgrading in the Global Clothing Industry: Mavi Jeans and the Transformation of a Turkish Firm from Full-Package to Brand-Name Manufacturing and Retailing", *Economic Geography*, 80(3): 221-240.
 - and Y.B. Eldener (2004) "Upgrading in the global clothing industry: the transformation of Boyner Holding", *Competition & Change*, 8(2):173-193.
- Tridico, P. (2004) "Institutional Change and Economic Performance in Transition Economics: The case of Poland", *Sussex European Institute Working Paper* No. 74.
- Tsai, K.-H. and J.-C. Wang (2008) "External technology acquisition and firm performance: A longitudinal study", *Journal of Business Venturing*, 23: 91-112.
- Tsekouras, G. (1998) *Integration, Organisation and Management: Investigating Capability Building*, DPhil Thesis, SPRU, University of Sussex.
- United Nations Economic Commission for Europe (1993) "Changes in the commodity composition of trade", *Economic Bulletin for Europe*, 45:124, New York.

- (1992a), "The ECE economies in 1992", *Economic Bulletin for Europe*, 44: 1, New York.
- (1992b), "Foreign trade of the transition countries", *Economic Bulletin for Europe*, 44:47, New York.
- UNECE Statistical Division Database (2013) http://www.unece.org/stats/stats_h.html accessed on 18/09/2013.
- United Nations (2001), *World Investment Report, Promoting linkages*, New York and Geneva.
- Uzzi, B. (1996) "The sources and consequences of embeddedness for the economic performance of organizations: The network effect", *American Sociological Review*, 61 (4): 674-698
- (1997) "Social Structure and Competition in Interfirm Networks: The Paradox of Embeddedness", *Administrative Science Quarterly* 42(1): 35-67.
- Van Tulder, R. and Ruigrok, W. (1998) "European Cross-National Production Networks in the Auto Industry: Eastern Europe as the Low End of European Car Complex", *BRIE Working Paper* 121.
- Veal, M.R. and K.F. Zimmermann (1996) "Pseudo- R^2 measures for some common limited dependent variable models", *Journal of Economic Surveys*, 10: 241-260.
- Veugelers, R. and B. Cassiman (1999) "Make and buy in innovation strategies: evidence from Belgian manufacturing firms", *Research Policy*, 28(1): 63-80.
- Von Hippel, E. (1988) *The Sources of Innovation*, Oxford, Oxford University Press.
- Von Tunzelmann, G.N. (2010a) "Alignment, Misalignment and Dynamic Network-based Capabilities", in D.A. Dyker (ed.) *Network Dynamics in Emerging Regions of Europe*, Imperial College Press, London, pp.3-22.
- (2010b) "The UK Innovation System, from a Misalignment Perspective", in D.A. Dyker (ed.) *Network Dynamics in Emerging Regions of Europe*, Imperial College Press, London, pp.25-44.
- (2004) "Network alignment in the catching-up economies of Europe", in McGowan, F., S. Radošević and G. N. von Tunzelmann (eds.) *The emerging industrial structure of the wider Europe*, Routledge, 23-37.
- (1995) *Technology and Industrial Progress: The Foundations of Economic Growth*, Edward Elgar, Aldershot.
- and Q. Wang (2007) "Capabilities and production theory", *Structural Change and Economic Dynamics*, 18:192-211.
- and V. Acha (2005) "Innovation in 'Low-Tech' Industries", in J. Fagerberg, D.C. Mowery and R.R. Nelson (eds.), *The Oxford Handbook of Innovation*, Oxford, Oxford University Press, pp.407-432.
- and D. E. Yoruk (2004) "Network realignment in the CEE food-processing industry". in McGowan, F., S. Radošević and G. N. von Tunzelmann (eds.) *The emerging industrial structure of the wider Europe*, Routledge, 77-94.
- . and F. Charpiot-Michaud (2000) "Food-processing in Western and Eastern Europe: From Supply-driven towards Demand-driven Progress", in C. von Hirschhausen and J. Bitzer (eds), *The Globalisation of Industry and Innovation in Eastern Europe: From Post-socialist Restructuring to International Competitiveness*, Cheltenham: Edward Elgar, 161-184.
- Walker, G. (1988) "Network analysis for cooperative interfirm relationships", in F. J Contractor and P. Lorange (eds.), *Cooperative Strategies in International Business. Joint Ventures and Technological Partnerships between Firms*, Lexington: Lexington Books, KY, pp. 227-240.
- Weresa, M.A. (2004) "Can foreign direct investment help Poland catch up with the

- EU?", *Communist and Post-Communist Studies*, 37 (2004) 413–427.
- Wernerfelt, B. (1984) "A resource-based view of the firm", *Strategic Management Journal*, 5: 171-180.
- Westney, E. 1988 "Domestic and Foreign Learning Curves in Managing International Cooperative Strategies", in F. Contractor and P. Lorange (eds.), *Cooperative Strategies in International Business*, Lexington, MA: Lexington Books.
- Westphal, L.E., L.Kim and C.J. Dahlman (1984) "Reflections on Korea's Acquisition of Technological Capability", *World Bank Development Research Department Discussion Paper*.
- Williamson, O.E. (1999) "Strategy Research: Governance and Competence Perspectives", *Strategic Management Journal*, 20: 1087–1108.
- (1981) "The Economics of Organization: The Transaction Cost Approach", *American Journal of Sociology*, 87(3):548-577.
- Wilson, D. and Möller, K. (1995) "Dynamics of Relationship Development", in Möller, K. and Wilson, D. (eds.) *Business Marketing: An Interaction and Network Perspective*, Dordrecht, Kluwer Academic Publishers, 53-69.
- Winkelmann, L. and R. Winkelmann (1997) "Determining the relative labour force status of Māori and non-Māori using a multinomial logit model", *Labour Market Bulletin*, 1: 24-62.
- Witt, U. and Zellner, C. (2009) "How firm organizations adapt to secure a sustained knowledge transfer", *Economics of Innovation and New Technology*, 18(7): 647-661.
- Whitaker, M. and R. Howard (1987) "Technical change and buyer-supplier relationships in the clothing industry", *The Innovation Research Group, Centre for Business Research, Brighton Business School, Brighton Polytechnic*.
- Woodward, R., D.E.Yoruk, P. Koc and W. Pander, 2010, "Knowledge-based entrepreneurship in Poland", CASE Network Studies and Analyses, No. 408 http://www.case-research.eu/sites/default/files/publications/30570001_CNSEA_408_0.pdf
- World Bank (2002) "Transition. The First Ten Years. Analysis and Lessons for Eastern Europe and the Former Soviet Union", The International Bank for Reconstruction and Development and The World Bank, Washington D.C..
- (1990) "Poland: Economic Management for a New Era", A World Bank Country Study, Washington D.C.
- Yoruk, D.E. (2004) "Patterns of industrial upgrading in the clothing industry in Poland and Romania", in F. McGowan, S. Radošević, N. von Tunzelmann (eds), *The Emerging Industrial Structure of the Wider Europe*, London: Routledge, pp. 95-110.
- (2003) "Impact of inter-organisational networks on industrial upgrading at the firm level: Evidence from the Romanian food-processing industry", in New Europe College (ed.), *NEC Yearbook*, Bucharest.
- (2002a) "Global Production Networks, Upgrading at the Firm Level and the Role of the Network Organiser: The Case of Vistula SA In Poland", *SSEES Working Paper* No. 28, SSEES, UCL.
- (2002b) "Role of network development in the growth of firms: the case of a Romanian bakery company", *SSEES Working Paper* No. 27, SSEES, UCL.
- (2002c) "Growth of a Polish meat company: mergers and acquisitions and the role of strategic investors", Working Paper No. 18, SSEES, UCL.
- (2002d) "Industrial Integration and Growth of Firm in Transition Economies: The case of a French Multinational Company", *Working Paper series in Economics and Business*, No.20, Centre for the Study of Economic and Social Change in Europe, SSEES, UCL.

- and von Tunzelmann, N. (2006) "Knowledge Accumulation, Networks and ICTs: Evidence from Traditional Industries in Central and East Europe", in K. Piech and S. Radošević (eds), *The Knowledge-Based Economy in Central and East European Countries: Countries and Industries in a Process of Change*, London: Palgrave Macmillan, 110-126.
- and R. Woodward (2005), "Potential and Opportunities for Innovation Networking in Traditional Industries with Buyer-Driven Value Chains: Case Studies of Polish Enterprises", in R. Woodward ed., *Innovation Networks in the Polish Economy – Current State and Development Prospects*, CASE Report No.60/2005, the Center for Social and Economic Research, Warszawa, Poland (published in Polish).
- and von Tunzelmann, N. (2001) "Role of multinationals and network alignment in East Europe: the case of an agribusiness company", Working Paper No. 6, SSEES, UCL.
- and Radošević, S. (2000) "International expansion and buyer-driven commodity chain: the case of Tesco", *SSEES Working Paper No.4*, SSEES, UCL.
- Yoruk, E. (2011) "The influence of technological capabilities on the knowledge network component of innovation systems: evidence from advanced materials in Turkey", *International Journal of Technological Learning, Innovation and Development*, 4(4): 330–362.
- Zacher, L. (1997) "Poland: Technology problems in a typical transition economy", in D. A. Dyker (ed), *The Technology of Transition. Science and Technology Policies for Transition Countries*, Central European University Press, Budapest, pp.28-42.
- Zahra, S. A. and George, G. (2002). 'Absorptive capacity: a review, conceptualisation, and extension', *Academy of Management Review*, 27, 185–203.
- Zander, I. (1999) "How do you mean 'global'? An empirical investigation of innovation networks in the multinational corporation", *Research Policy*, 28: 195–213.
- Zukin, S. and P. DiMaggio (1990) *Structures of Capital: The Social Organization of the Economy*, Cambridge University Press, Cambridge, MA.
- Zukowska-Gagelmann, K. (2000) "Productivity spillovers from foreign direct investment in Poland", *Economic Systems*, 24(3):223-256.
- Zysman, J. and Schwartz, A. (1998) "Reunifying Europe in an Emerging World Economy: Economic Heterogeneity, New Industrial Options, and Political Choices", *BRIE Working Paper No.113*.
- , E. Doherty and A.Schwartz (1997) "Tales from the 'global' economy: Cross-national production networks and the reorganization of the European economy", *Structural Change and Economic Dynamics*, 8: (45-85).

APPENDICES

APPENDIX A: GOVERNANCE IN GLOBAL VALUE CHAINS – A TOOL OF ANALYSIS

In the GVC framework of Gereffi (1999), coordination of the value chain via networks and organisational learning is directly and explicitly linked to the ‘lead firm’, which exercises the power on different stages of the value chain. It also controls the access to major resources (such as product design, new technologies, brand names, or consumer demand) that generate the most profitable returns in the industry. In his words, “These lead firms are not necessarily the traditional vertically integrated manufacturers, nor do they even need to be involved in making finished products. They can be located upstream or downstream from manufacturing (such as the fashion designers or private label retailers in apparel), or they can be involved in the supply of critical components (such as microprocessor companies like Intel and software firms like Microsoft in the computer industry)”. This lead firm is central to the framework in the sense that it determines the governance within the value chain.

Gereffi (1999) suggests two distinct types of governance that is driven by either producer or buyer in the value chain at the international level (see Table A.1). In the producer-driven GCC, he emphasises the role of multinational enterprises, which usually belong to global oligopolies, as the coordinator of the international production networks (including their backward and forward linkages) with their subsidiaries as manufacturers in the developing countries. Their profits derive from scale, volume, and technological advances, which is why producer-driven value chains are controlled by industrial firms at the point of production. Capital- and technology-intensive industries such as automobiles, aircraft, computers, semiconductors and heavy machinery appear to be the characteristic of producer-driven GVC.

Table A.1 Main characteristics of producer- and buyer- driven value chains

	Producer-driven GVCs	Buyer-driven GVCs
Driver of GVC	industrial capital	commercial capital
Lead firm (at international level)	transnational firms	large retailers, branded marketers, branded manufacturers
Core competencies (at firm level)	research and development; production	design; marketing
Barriers to entry (at sectoral level)	economies of scale	economies of scope
Economic sectors	consumer durables, intermediate goods, capital goods (<i>capital- and technology-intensive industries</i>)	consumer nondurables (<i>labour-intensive, consumer goods industries</i>)
Typical industries	automobiles; computers; aircraft; <i>food</i>	apparel; footwear; toys
Ownership of manufacturing firms	subsidiaries, affiliates or subcontractors of transnational firms; large local firms with or without strategic investors	local firms, predominantly in developing countries
Main network lines	investment-based	trade-based
Predominant network structure	vertical	horizontal
Rents (typology of Kaplinsky 1998)	technology and organizational rents	relational, trade-policy and brand-name rents
Source: Gereffi (1999)		

Whereas buyer-driven value chains emerge from trade-led industrialisation in labour-intensive consumer goods industries and are essentially governed by large retailers, brand-name manufacturers and marketers as well as trading companies, through decentralised production networks in a variety of countries (Gereffi 1994: 41-3). In buyer-driven value chains, highly competitive, locally owned, and globally dispersed production systems necessitate “strategic brokers in linking overseas factories with evolving product niches in the main consumer markets”; these brokers need an “ability to shape mass consumption via strong brand names and their reliance on global sourcing strategies to meet this demand” (Gereffi 1994: 43). Manufacturers comply with their product specifications, but large retailers and brand-name companies are not involved in the production process at all. They create global sourcing networks, but do not necessarily own factories themselves. Thus they are known as

‘manufacturers without factories’ – particularly in the apparel industry. They separate the physical production of goods from the activities where their profits lie, such as high-value research, design, sales, marketing and financial services (Gereffi 1999). In addition, the governors (or key actors) of the value chains not only enjoy high profits but also exert high entry barriers into the chain.¹⁹⁹ They, in a way, determine who gets ahead in the chain, and who does not.

APPENDIX B:

B.1 ROOTS OF NETWORKS IN THE LITERATURE

Having emerged as a response to the theory of ‘internalisation’ associated with transaction-cost approach,²⁰⁰ the network approach is based itself on ‘externalisation’. It fundamentally differs from the transaction-cost approach with its theoretical foundations that reject the stable equilibrium of neoclassical economics, the importance of the legal framework of transactions and the lack of clarity on boundaries of the individual organisations; and with its interest in coordination of activities *among* organisations rather than within organisations (Johanson and Mattson, 1987). As is the case in the typology of relationships discussed above, transaction-cost studies reduce the influence of the external networks “to a summary variable measuring the degree of supplier market competition in a market; the fewer the suppliers, the greater the risk that prices may be renegotiated, especially if the buyer cannot switch easily to other sources” (Kogut *et al.* 1992: 348). In the literature, vertical integration of the firm is justified under these grounds (i.e. hierarchy). Transaction costs do gain importance when explaining the vertical integration or interactions of firms in markets; yet lose importance in networks that rely on *exchanges* rather than transactions (Cook and Emerson 1978).

One can make use of the work of Langlois (1992), who has improved the static transaction costs approach to the ‘dynamic’ by recognising ‘learning’ in the firm (see Williamson 1999 for opposition). Learning diminishes the importance of transaction costs in the long run, *ceteris paribus*, through changes in the capabilities of the firm. Then the definition of transaction costs, in his wording, takes the form of being “the costs of not having the capabilities you need when you need them”, which arise from “the costs of persuading, negotiating, coordinating and teaching outside suppliers” (*ibid.*, p. 114). He establishes his model on the trade-off between internal and external capabilities of the firm. Either failures in, or high costs of, internal capabilities lead firms to disintegrate and search for external capabilities, which are available to the firm through contract, in the market. Similarly, recent analyses of governance argue that networks have come to existence by dealing with ‘failures’ of other forms of governance such as market failure, corporate failure, government failure (Dyker and von Tunzelmann 2002, von Tunzelmann 2004).²⁰¹

¹⁹⁹ Gereffi (1999: 43) discusses entry barriers in the value chain in relation to *rents*, which are adapted and extended on the basis of the typology of rents by Kaplinsky (1998).

²⁰⁰ Williamson (1981) examines the internalization of the activities of the firm due to two types of market failures. The first is asset specificity, in which the introduction of product-specific equipment (relaxing the neoclassical homogeneous inputs assumption) allows for opportunistic behaviour when a supplier is held hostage by its customer. The second is demand externality, where the product quality in the absence of the manufacturer’s control cannot be ensured by the market contract; here, the market contracting is lessened in order to ‘economise’ on transaction costs. This implies an increase in the size of the firm (due to vertical integration) with the increase in asset specificity and demand externality. Consequently, the existence of the transaction costs may encourage the growth of the firm through merger, acquisition and internal expansion (Kay 1999).

²⁰¹ The failures of forms of governance are not mutually exclusive. For instance, efforts to replace governance failure in the socialist period of CEE with markets have proved to be inconclusive due to presence of market failures. In addition, von Tunzelmann (2004) argues that the prevailing type of failure during transition process of the CEECs is ‘network failure’.

Langlois (1992) suggests that when the market cannot provide the capabilities at the right time, vertical integration may occur; and when the firm lacks the right capabilities at the right time, vertical disintegration may occur. Networks then appear as an alternative for the vertical integration of the firm, which emerges with the vertical disintegration, but when the internal knowledge and capabilities of the firm is not sufficient and relevant for the intended functioning of the firm.²⁰²

B.2 NETWORK THEORIES OF THE FIRM

Networks have emerged as a distinctive form of coordinating economic activity based on reciprocity and collaboration, namely the 'network mode of organisation' (Powell 1990, also Hägg and Johanson 1983 – the Uppsala School). Powell (1990) argues that, unlike market transactions in the neoclassical characterisation, the network form of exchange evolves within a pattern of interactions that take place among firms and they are embedded in social ties or structure (though including personal ties and market relationships among various parties; see also Granovetter 1985). So, in networks there is neither the invisible hand of the market to coordinate demand and supply nor management's visible hand to establish an authoritative system of order; instead there is dependence of one party on resources controlled by another in reciprocal, preferential, and mutually supportive relationships with explicit gains from pooling of the resources of these two parties (Powell 1990).

The interest of the Uppsala School in simple buyer-supplier relationships inspired the industrial networks literature, which in particular focuses on co-operative marketing activities of firms, and the mechanisms by which they stimulate the development of further networking activity (e.g. in the areas of production specialisation, knowledge and technology transfer, etc.). Initially, this concept was to serve as a tool for understanding industrial development by explaining the relationships among actors in an industry (e.g., suppliers, producers and customers) (Håkansson 1989). At a time when transaction cost economics was at its peak, they initiated a 'network approach' with special emphasis on the emergent and dynamic nature of networks, which has been mostly studied as an aspect of technical change (e.g. Håkansson 1990a, 1990b, Håkansson and Lundgren 1995).²⁰³ It assumed heterogeneity of resources, and stressed the interconnectedness and strong mutual dependence, mostly in coordination of the activities and resources between actors in dyadic relationships (Mattson 1997). They conducted a number of empirical studies in industrial marketing and development (Mattson 1985; Håkansson 1987). These empirical studies paved the way for the network analysis of firms, approaching real world complexity.

The strategy perspective on networks introduced the 'strategic' dimension to networks and linked it to competition by viewing embedded firm relationships as a competitive advantage of the firm vis-à-vis its competitors outside the network and hence a significant factor influencing its conduct and performance (Jarillo 1988, Gulati 1998, Gulati *et al.* 2000, Doz *et al.* 2000, Dyer and Nobeoka 2000).²⁰⁴ Gulati *et al.* (2000: 203) highlighted the strategic advantages of networks as access to information, resources, markets and technologies, and achieving strategic

²⁰² Another effort to synthesise a dynamic analysis of transaction costs and capabilities perspective through the evolution of inter-firm collaborative relationships can be found in Madhok (2000).

²⁰³ Håkansson (1989: 16-17) defined three components of an industrial network – actors, resources and activities – that are linked to each other within industrial systems by means of control (actors control resources), performance (actors perform activities) and consumption of other resources (activities change or exchange resources through use of other resources). In later works, Håkansson successfully linked these industrial networks to technological cooperation, innovation and product development (e.g. Håkansson 1990, 1990b, Håkansson and Lundgren 1995). A literature review of strategic business networking and technological linkages in the Scandinavian context can be found in Johannisson and Monsted (1997).

²⁰⁴ Gulati *et al.* (2000) elaborate five strategic areas in which strategic networks affect firms' conduct and performance, in relation to the industrial organization school and resource-based view.

objectives such as risk sharing, outsourcing, and so on. This school is interested in a specific form of networking called 'alliances' (for a fuller literature review on international strategic alliances see Lu and Burton 1998). In prior research, alliances are considered as dyadic exchanges that are embedded in larger network (Gulati 1998). Later they evolved into 'strategic alliances' and are defined as inter-firm cooperative agreements that are based on complementarity of capabilities and resources between the partner firms to create business opportunities by pooling financial, human, knowledge and technological resources that neither partner could pursue alone such as joint ventures and mergers (Garette and Dussauge 2000).²⁰⁵ Michalet (1991) distinguishes the 'network firm' (Antonelli 1988, 1991) or 'hollow corporation' (Smidt and Wever 1990) from 'alliances'. The former is a new type of multinational company that has arisen with the need to internalise externalities by means of decentralised but still strongly hierarchically-controlled value chains (Chesnais 1992: 282), which is in fact similar to the Gereffi's buyers in GVCs with strength in brand names and marketing. Alliances formed to pool financial, human, knowledge and technological resources in some joint activities with other organisations. Strategic technology alliances intend to affect the long-term product-market positioning of at least one partner and aim at overcoming technological complexity and complementarities, reducing uncertainty, costs of R&D and product development time, and accessing the partner's knowledge and capabilities (Hagedoorn 1993, Simonin 1997, Narula and Hagedoorn 1997; Ahuja 2000, Chung *et al.* 2000, Duysters and Hagedoorn 2000, Narula and Sadowski 2002). Research on strategic (technology) alliances examines their contribution to learning and innovation in firms, particularly in relation to global changes in industrial structure and competitiveness (Mytelka 1991, 2001; Hamel 1991; Doz 1996, Inkpen 1998).

In the evolutionary literature, networks are located within the broad structure of the systems of innovation (e.g. Freeman 1987, 1992; Lundvall 1992a; Edquist 2001; Malerba 2002, 2005), technological systems (Carlsson and Stankiewicz 1991, 1995; Carlsson 1994, 1995) and the learning economy (Archibugi and Lundvall 2001). With special emphasis on technology and innovation, evolutionary approaches to networks have differed from previous approaches by attempting to unfold the generation, transfer, use and diffusion of knowledge and learning through interaction between organisations. With slight nuances, they are called innovation networks (Zander 1999, Fritsch 2001), knowledge networks (Gelsing 1989 and 1992, Hansen 2002, Oven-Smith and Powell 2004, Dantas and Bell 2009), learning networks (Bessant and Francis 1999), R&D partnerships / networks (Hagedoorn *et al.* 2000, Hagedoorn 2002, Criscuolo 2005) and used interchangeably. They examined in detail network-based nature of sourcing knowledge and technological learning with a focus on inter-firm relations or relations between firms and specialised knowledge-generating organisations (such as universities and R&D institutes). Coombs and Metcalfe (2000) argue that firms would be interested in engaging in networks for innovation when they do not possess the necessary knowledge and innovative capabilities (in other words, to acquire, combine, create and exploit technology, knowledge and capabilities). They group networks under five broad areas, based mainly on the creation and exploitation of new capabilities developed within these relationships. Similar to Humphrey and Schmitz (2004), they locate these relationships in between market transactions and fully internalised capability development. Briefly, they are *predominantly market-mediated*

²⁰⁵ Approaches to strategic alliances have been varied in the literature. One is an extension of transaction cost economics, where strategic alliances represent all possible cooperative types, with equity investment as well (namely; mergers and acquisitions (M&As), joint ownership, joint ventures, formal cooperative ventures and informal cooperative ventures), lying between free market transactions on one hand and total internalisation or vertical integration on the other, and thus a very broad concept (Lorange and Roos 1993). This cooperative strategy approach to networks gives importance to the trust and confidence developed between the partners through time, effort and resources invested in it in order to create a common orientation toward individual and mutual goals, such that over time they evolve into linkages strong enough to blur the boundaries of the relationship (Contractor and Lorange 1988, Wilson and Moeller 1995; Spekman and Celly 1995). It seeks immediate returns from alliances (Lorange and Roos 1993).

relationships that include payment of a fee in return for the transfer of technology, knowledge or capability, *multi-firm collaborations with the special purpose of producing generic knowledge* for the use of all partners rather than transferring knowledge between partners, *application-oriented collaborations* with more focus on innovation in marketing, production and R&D, *joint venture companies* with greater institutional and legal stability, and *strategic alliances* with the distinguishing character of 'trust'.

APPENDIX C: SAMPLING AND PILOT QUESTIONNAIRE SURVEY

Table C.1 The distribution of registered large firms in the Polish food-processing and clothing industries in 2000 by size (number of employees)

Firm size Number of employees	Food-processing firms			Clothing firms		
	Number of firms	% in total	% in 500+	Number of firms	% in total	% in 500+
250-499	155	63.8		92	66.2	
500-599	18	7.4	20.2	14	10.1	29.8
600-699	11	4.1	12.4	6	4.3	12.8
700-799	15	6.2	16.9	5	3.6	10.6
800-899	12	4.9	13.5	2	1.4	4.3
900-999	2	0.8	2.2	2	1.4	4.3
1000-1499	18	7.4	20.2	10	7.2	21.3
1500+	13	5.3	14.6	8	5.8	17.0
Sub-total for 500+	88	36.2	100.0	47	33.8	100.0
TOTAL	243	100.0		139	100.0	

Source: Polish Embassy UK website, www.polishemb-trade.co.uk/Home_en/Main_en.htm (accessed in October-November 2000)

QUESTIONNAIRE

PLEASE RETURN THE QUESTIONNAIRE, EVEN IF YOU CANNOT ANSWER ALL THE QUESTIONS.

PLEASE FILL IN THE BLANKS OR CROSS THE BOXES AS APPROPRIATE.

IF YOU WOULD LIKE TO HAVE CONFIDENTIALITY OF YOUR ANSWERS AND YOUR COMPANY NAME, PLEASE CROSS THIS BOX. ☐

Name of your company: _____

Year of foundation: _____

1) What is the status of your company?

(A *multi-location domestic company* is a company which has several production units in different locations within the same country under the same name with the headquarter domestic company or under different names from it.)

☐ Independent company ☐ Headquarter of a multinational company

☐ Headquarter of a multi-location domestic company ☐ Wholly-owned subsidiary

☐ Part of a multi-location domestic company ☐ Part of a holding company

☐ A share owned company

☐ Other (please specify) _____

1.a) If your company is a part of a multinational company, in which country is the parent company located? _____

1.b) If your company is a privatised domestic company, when was it privatised? _____

(Note: If your company is part of a multinational company or a multi-location domestic company, please answer all the below questions according to the facts and activities of only your company, not the entire Group.)

2) (for clothing firms) Which of the below products does your company produce? (If necessary please cross more than one option and delete as appropriate)

☐ men's/boys' outerwear / underwear ☐ sportswear ☐ bed linen, table cloth
☐ women's/girls' outerwear / underwear ☐ workwear ☐ carpets, rugs

Other (please specify) _____

2) (for food-processing firms) Which of the below products does your company produce? (If necessary please cross more than one option)

☐ meat and meat products ☐ sugar ☐ bakery products

☐ dairy products ☐ fruit and vegetable processing ☐ edible oil
☐ confectionery ☐ beverages ☐ animal feed

Other (please specify) _____

3) How many people does your company employ?

a) in production ☐ 251- 500 ☐ 501-750 ☐ 751-1000 ☐ 1001-1250 ☐ 1251-1500 ☐ >1501

b) total employment (including marketing, retailing, etc.)

☐ 251- 500 ☐ 501-750 ☐ 751-1000 ☐ 1001-1250 ☐ 1251-1500 ☐ >1501

4) What are the total sales of your company in the last financial year? (delete the currency as appropriate)

_____ Dollar / national currency

5) What is your company's growth rate of total production in the last five years (or since it was established, if your company is functioning for less than five years)?

☐ <0 ☐ 0-2% ☐ 2.1-5% ☐ 5.1-10% ☐ 10.1-15% ☐ 15.1-20% ☐ >20%

6) What percentage of your products does your company export?

☐ 0% ☐ 1-10% ☐ 11-25% ☐ 26-50% ☐ Other (please specify) _____ %

7) How many suppliers and customers does your company have according to the geographical distribution below?

(A *supplier* is a foreign or domestic company which provides the details (such as raw material, manufacturing equipment, intermediate product, etc.) of the manufacturing process of your products.
 A *customer* is a foreign or domestic company to which your company sells your products.)

	Number of Suppliers	Number of Customers
Local		
National		
East European		
West European		
International (excluding Europe)		

Please refer to the below definitions to answer the following questions:

(code:1) A *joint venture* is a new local company formed by two or more separate foreign and/or domestic companies, where ownership allocation is based on stakes controlled.

(code:2) *Majority or minority acquisition* is a purchase of the controlling (more than or equal to 50%) or non-controlling stakes (less than 50%), respectively, in a local company by foreign or domestic company or companies.

(code:3) *Subcontracting* is a sourcing method through which component assembly or supply is provided by an independent domestic supplier to your production chain or by your company to other foreign or domestic company's production chain.

(code:4) *Original Equipment Manufacturer (OEM)* is a specific form of subcontracting where your firm provides a product according to the specifications the foreign (customer) firm requires.

(code:5) *Licensing* gives the opportunity to the domestic firm to exploit the intellectual property of a foreign firm, e.g. patent, know-how, in return for a payment of a fee or royalty based on sales.

(code:6) *Research consortia* consist of a number of foreign and local companies working together on a specific project.

(code:7) *Strategic alliance* is an agreement between two or more foreign and/or domestic firms, which may have customer or supplier relations, to co-develop a new technology or product.

(code:8) *Co-operation with potential competitors* aims to benefit from the sources of complementary activities and technological or market know-how of foreign competitors.

8) If your company has co-operations with other companies in one or more of the activities below, which type or types of co-operations does your company have? (*Please match the activities with the appropriate type of cooperation. If necessary please cross more than one type of cooperation for each activity.*)

Activity	Code 1	Code 2	Code3	Code 4	Code 5	Code 6	Code 7	Code 8
Supplier relation								
Product development								
Manufacturing process development								
Quality improvement								
Employee training								
Research & Development								
Technology transfer								
Customer relation								
Distribution relation								
Other (please specify)								

9) Is your company involved in one or more of the inter-firm relations below with other companies? Yes ☐ No ☐ If yes, what is the number of these inter-firm relations with foreign and domestic companies?

	Number of foreign companies	Number of domestic companies
Joint venture		
Acquisitions		
Other (please specify)		

10) Is your company involved in one or more of the inter-firm relations below with other companies? Yes ☐ No ☐ If yes, what is the number of these inter-firm relations with foreign and domestic companies?

	Number of foreign companies	Number of domestic companies
Subcontracting		
OEM		
Licensing		
Research consortia		
Strategic alliances		
Co-operation with potential competitors		
Other (please specify)		

Name of the person who speaks English in your company: _____

Phone number: _____

Fax number: _____

e-mail address: _____

Table C.2 The number of companies the pilot questionnaires sent and received from

	Food-processing	Clothing	Total
domestic firms	50	29	79
MNC subsidiaries	14	2	16
Total sent	64	31	95
domestic firms	7	10	17
MNC subsidiaries	8	0	8
Total response	15	10	25
% Total	23.4	32.3	26.3

Source: Author

APPENDIX D: INTERVIEW QUESTIONS (WITH FIRMS)

Basic information

Date of interview:

Name of Interviewee:

Industry:

Position in the company:

Company name:

Division in the company:

Main activity:

Telephone/Fax:

Address:

E-mail:

1. Background

What is the status of your company?

(Independent company, headquarter of a multi-location domestic company, part of a multi-location domestic company, part of a holding company, a share-owned company, etc.)

If your company is privatised, when was it privatised?

(Note: If your company is part of a multi-location domestic company, please answer all the following questions according to the situation and activities of only your company, not the entire Group.)

When was your company founded?

Which of the following products do you produce?

(For clothing companies: men's/boys' outerwear / underwear, sportswear, women's/girls' outerwear / underwear, workwear, other)

(For food-processing companies: meat and meat products, sugar, bakery products, edible oil, dairy products, fruit and vegetable processing, confectionery, beverages, animal feed, other)

How many people does your company employ?

a) total employment (including marketing, retailing, etc.); b) in production; c) in management and finance

What percentage of your products does your company export?

Which of the following activities does your company conduct in its main operation?

(Production, Assembly, R&D, Distribution, Marketing, Training, After-sales service, other)

Is there a research laboratory or product development unit in your company?

If YES, What is/are the purpose(s) of this laboratory/unit in your company? (Product developments and improvements, process developments and improvements, scientific research, applied research, design, quality control, gathering commercial and technical information outside your firm, establishing relationships with other organisations, etc.) How many employees work in this laboratory/unit? What are their specialisations? With which departments do/did they collaborate in the company? What amount has your company spent on product development and research (approximately) since your company has been privatised or has started-up? Has this amount increased or decreased during your partnerships with other organisations? And by approximately what percentage?

If NO, Do you subcontract another organisation (i.e. outsource) to make research for your company? What is/are the purpose(s) of subcontracting other organisation(s) (i.e. outsourcing) for your company? (Product developments and improvements, process developments and improvements, scientific research, applied research, design, quality control, gathering commercial and technical information outside your firm, establishing relationships with other organisations, etc.)

What kind of organisations does your company subcontract for research (i.e. outsource)? (Public/private research institutes, public/private research laboratories, independent consultants, food-processing ingredient suppliers, food-processing equipment suppliers, other)

What amount has your company spent on subcontracting other organisation(s) (i.e. outsourcing) for research (approximately) since your company has been privatised or has started-up? Has this amount increased or decreased during your partnerships with other organisations? And by approximately what percentage?

Is there an ongoing research project in which your company is involved? Yes / No

How do you phrase your company strategy?

2. Determining the relationship

Since 1989 till today (2001),

Other than buying-selling relationships on the market, does/did your company cooperate with your suppliers? (in improving production processes you use, technology transfer, new product development or modifications to existing products in your company, product quality improvements, training of your employees, introducing a new department and/or function into your company, introducing novelty into your managerial/organisational system such as teamwork of individuals from different departments, with regard to effective and innovative use of your supplier's products)

If technology suppliers: Focus more on the information about acquisition of new technology and machinery & equipment processes, ability to get/extract information about the state of the art in technology and production, training received, after-sale services versus ability to deal with the problems appeared later on by themselves - especially after the initial training and learning-by-doing experiences.

If raw material suppliers: To what extent do you develop links with upstream producers and raw material suppliers? (agricultural production-farmers in food-processing industry and equipment and material suppliers in clothing industry)

Does/did your company cooperate with your *customers / buyers and/or end-user firms*? (in product development or modifications to existing product, in design, in marketing and distribution, receiving feedback, etc.)

To what extent do you develop the links with *downstream users / distributors / other actors*? (markets for end-products)

Does/did your company cooperate with *competitor firms (your rivals) in your industry*? (in research, market research, distribution, etc.)

Does/did your company cooperate with *complementary firms in your industry*? (in production, distribution, joint research, etc.)

Does/did your company collaborate with *universities*? (in improving production processes, in product development, in receiving consultancy or advice on advances in S&T from university professors, in adopting new technologies, in conducting special tests in student internship or doctoral theses, in participation to conferences, seminars, in sending your employees to special courses at the university, etc)

Does/ did your company collaborate with *public or private research institutes, laboratories*? (in improving production processes, in product development, in adopting new technologies, in receiving consultancy, in student internship or doctoral theses, in participation to conferences, seminars, in sending your employees to special courses, programmes at the university, etc.)

Does/ did your company cooperate with *consultants and/or consulting firms*? (in receiving consultancy in product development, in technological and scientific developments, in training of the employees and managers to improve their skills, in adoption of new organisational and managerial developments, in developing marketing and distribution channels of your company, in advertising, etc.)

Does/ did your company cooperate with *export / intermediary agencies*? (in finding customers and suppliers, in marketing your products to the markets that you have difficulty to have access, etc.)

Does/ did your company cooperate with *design agencies*? (in product development, in increasing product image and marketing, in advertising, etc.)

Does/ did your company cooperate with *human resource or advertising agencies*? (in training managers, in recruiting skilled people, etc.)

Does/ did your company cooperate with *Chamber of Commerce or industrial associations*? (in training through regional / national apprenticeship programmes, through sector-based training initiatives, etc.)

Does/ did your company cooperate with *governmental institutions*? (in training through regional / national apprenticeship programmes, through sector-based training initiatives, etc.)

(Repeat the below questions for every relationship.)

3. The beginning of the relationship

In which year has/had the relationship started? Did it end or does it still continue?

Has/had it ended and started again?

Would you please briefly tell the history of your relationship with your partner? How does/ did it start? Who initiated the relationship? (your company or the partner) / How does/did your company get to know your partner? (intermediary agents, personal contact, the partner found you, etc.) What is/was the relationship about? (to get a rough idea whether to pursue it or not; and if so, in order to elaborate here onwards)

4. The partner and the roles

Who is/was your partner? Is/Was the partner foreign or domestic? Where does/did the partner locate? (abroad, in Poland, in your local area)

What is/was your specific role in the relationship? What is/was the role of the partner in the relationship? Who has/had the coordinating role within/throughout the relationship, your company or the partner company?

What do you think are/were the consequences of this division of roles? Do you think your company benefited from being guided by your partner (or guiding the partner)? If yes, in what ways?

Has/had your partner introduced something new to your company – so what is/was it?

(This question is an introduction to the presence of ‘learning external to the firm’, and will be elaborated with following detailed questions and confirmed by asking the same thing in different formats.)

5. Motivations

What is/was your company’s main motivation in getting involved in this relationship?

What do you think your partner’s main motivation is/was?

6. Continuity of the relationship (Based on the answer in section 4)

If the relationship is continuing: For how long has/had been your relationship continuing with this partner?

If ended: When did it end and why?

Ended and re-started again: When did it end, when did it start again, and why? Is there a regular interval or a pattern your company cooperates with this partner? Why does/ did your company get involved in relationship with this partner from time to time?

7. Interaction

How often/frequent do/did your company and your partner interact/communicate during the relationship?

In what ways do/did you interact/communicate? (emails, fax correspondences, telephone, face-to-face meetings, in the form of training, in the form of mobility of people, etc.)

If emails, fax correspondences, telephone: What does/did the interaction involve?

(receiving product specifications, computer-aided designs, marketing reports, quality test results, scientific papers, advices, trademark, software programs, etc.) Are/were these correspondences with your partner a demand by the contract with your partner and have to be regular or spontaneous / unplanned/ ad hoc interaction happened to be as the need has/had arisen

for instance, to communicate to sort out problems? What are/were the specialisation of the people you correspond? What is/was the purpose(s) of these correspondences?

If face-to-face interaction (meetings, training, etc.):

Has/had the face-to-face meeting among people during the relationship occurred between two individuals or among groups of people? What are/were the specialisation of these people? What is/was the purpose(s) of having face-to-face meeting? Is/was such face-to-face interaction formally arranged or happened spontaneously when a need has/had arisen? Who arranges / arranged these face-to-face meetings: the managers of your company or by your partners' managers (which ones?), or among specialised people in both partners (as employees, engineers, etc.)?

Are/were they regularly held? How often are/were these face-to-face meetings? Who demands / demanded to meet regularly: your company or your partner? What are/were the main reasons to meet with your partner regularly?

Are/were they unplanned, spontaneous, improvised, ad hoc meeting (e.g., as a result of a problem-solving activity)? When generally is/was a meeting arranged between your company and your partner, and for what purpose(s)?

Has / had there been improvised/ unplanned/ ad hoc interaction between two people or groups of people? (e.g. with the technician of your partner in your company, among the researchers of your company and your partner's, your employees and university staff, etc.). What has/had been the main subject of the face-to-face meetings with this partner? (e.g. training associated with technology acquisition, adaptations in the production process, product development, technical advice for problem-solving in production processes, introducing quality assurance standards, information related to market and marketing capability development, etc.) What are/were the specialisation of these people? What is/was the purpose(s) of having face-to-face meeting?

Do you think regular face-to-face meetings/ unplanned face-to-face interaction with your partner are/were useful and important for your company or the relationship? If yes, what do/did you think their importance is/was? (communication becomes easy/less problematic, agreement about needs and demands reached easier than other methods of communication, learning things that the partner would willingly or unwillingly share or disclose gets easy, more spill-over opportunities arise, visual opportunities while discussing technical matters, turns into informal training easily, etc.)

8. Training

Has/had your partner offered any training to your employees and/or managers? (on-the-job training, through firm visits to the partner, by technicians sent by the partner firm to the firm employees - this is access to mainly personal practical know-how through face-to-face interactions-, apprenticeship programmes, sector-based training initiatives, college/university programmes, private consultants of the consulting firm or human resource companies, etc.) Have/had your company offered any training to employees or managers of your partner? (e.g. to suppliers [farmers], sales representatives of franchising companies, etc.) What is/was the training about? Where did it take place? What do you think the impact of this training has/had been on your employees, on your company, and on your partner?

Have /had your company cooperated with external agencies to provide training to your employees? Who provided training and in what subject matter? Where did it take place? For how long? What do you think the impact of this training has/had been in your company?

9. Mobility of people during relationship

Is/Was there any personnel exchange or mobility of workers between your company and your partners? (e.g., technicians/supervisors sent by the partner firm helping firm with for

problem-solving activities, employees of a research institute spending time in your company for a project undertaken with your company, a manager sent by the partner company for a special training or restructuring in your company, visit by your employees to the partner's plants, etc.).

If yes, for how long? (for short or long periods of time) How often? For what purpose(s)?

What is/was the level of interaction between your employees and the partner's employees? Is/ was the partner's employee willing to share his expertise with your employees? Or does/ did your employees find it difficult to communicate with him? Is/ was he helping to solve your problems that have/had arisen when he was in your company? Is/was he recommending you things related to his expertise only or is/was he involved in other things that are/ were going on in your company? Do/ did your employees learn new things to your company from him or does/ did the partner learned from your company? Is/was there knowledge exchange between them?

Do you think your company has/had gained by having this person in your company/by sending your employee out to your partner? If so, what is/was gained?

10. Knowledge acquisition / transfer in the relationship

What kind of information / knowledge does/did your company receive from/give to your partner? (e.g., related to your markets, products, production processes, technological advances in your industry, new methods in business and management, pure scientific knowledge, practical knowledge, quality related knowledge, etc.)

Is/was there anything particular that your company learned from your partner that is new, useful to your operations or changed your company organisation? (e.g., learned doing something that has never been done in your company such as teamwork, learned new ways of dealing with a problem such as a new problem-solving approach, partner introduced a new design, a new product, a new manufacturing method that your company has not known before, etc.) *(An introduction to the presence of the effect of the relationship on one of the upgrading types: Confirm once again and elaborate further)*

How does/did your company follow new advances in S&T? Do you think your company has learned new advances in S&T through this relationship? Does/ did your employees from a particular unit in your company work in collaboration with employees of your partners? (e.g., research Laboratory, design unit, production engineering unit, marketing unit, management, human resources unit, other).

Does/ did your company feel that your partner is /was in general supportive or not for the relationship to be successful? If yes, in what areas your partner is/was supporting you? If not, can/could you give some examples of not being supportive? Do you think those are /were the areas your company needed improvement?

Is/was your partner willing to share information / knowledge with your company? If yes, why? (in order to help your company to improve a specific function or competence that is important to the partner, to improve the level of standards in e.g., process manufacturing, other reasons) and, in what areas (e.g., to improve production processes in your company, to inform you about a particular supplier it uses, etc.) and in what ways does/did your partner convey its knowledge to your company? (arranging meetings, fax, email, phone, sending an employee, etc. / frequently being in contact and checking, conducting a teamwork, joint activity). If not, why do you think your partner was reserved to share information? Do / did your employees extract knowledge from your partner during the relationship through own observations of what and how the partner does/did things during the relationship e.g., while manufacturing a particular product / new approach to problem-solving or during interacting with your partner's employees e.g., in teamworks? (the company's own observations of what and how the

partner does/did things during the relationship, different forms of training that take/took place during the relationship, different forms of interaction of people during the relationship, sending technician –mobility of people, through repetition of your relationship with the partner, etc.). What has been improved / developed / changed within your company through this new knowledge from your partner?

11. Knowledge internalisation within the firm

In what ways does/did your company use this new knowledge from the partner within the company? In which operations of your company does/did your company used this new knowledge retrieved from your partner / during this relationship? Has/had it turned into a concrete idea, practice, routine or by-product? If yes, how does/ did this information / new knowledge shared within your company? How long did it take to improve / develop / change (refer to the answer for improvement, etc.)? Would you please tell the story behind it?

Does/did your company continue doing what you always do and over the years, does/did your company think that you can do (refer to the answer for improvement, etc.) as well and try it?

Does/ did the new knowledge simply used within the usual practices, routines of your operations? Which units are/were internal sources for knowledge and/or technology transfer for your company? (e.g., research Laboratory, design unit, production engineering unit, marketing unit, management, human resources unit, skilled workers, other).

Does/ did your company conduct/arrange special training to your employees for them to learn the new practices in line with the new piece of knowledge to your firm?

Does/did your company conduct search/research to benefit from this new knowledge to your firm by applying it within the firm?

How is /was this new knowledge shared within your company? Does/did one particular unit hold this new knowledge and applied it to its specific functions, or has /had it been used by several units or people in different units? Which units/specialised employees are/were involved in dissemination of this knowledge within the company? Does/did your company arrange any special activities within the firm? (e.g. meetings, seminars, workshops, teamwork) Did people from different departments gathered and discussed the matter, or did one unit in your company deal with it, or are/were all the employees in your company informed and/or affected by this new piece of knowledge? (e.g. quality management training) What has/had been the level of interaction among these employees / units? How do/did they come together, who arranged, how often?

12. Upgrading

What do you think is/ was the major change, improvement, development your company benefited out of this relationship? In other words, what do you think are/were your gains from your relationship with this partner? (Introduction of a new product to your domestic market, Introduction of a new product to your company, Introduction / acquisition of new process technology, Provision / Import of new machinery and equipment, Improvements in your (already existing) R&D unit Commence of an R&D unit, Improvement in your industrial design ability, Introduction of new training techniques at several levels (production, management, marketing, etc.), Enhancement in your network with other organisations, at national and/ or international level, Access to West European markets, Access to new domestic markets, Hire new people, who are significantly beneficial to your company, Other, please specify)

What do you think the extent of the influence of your partner in introducing this novelty in your company (a demand/requirement by the partner but no help is/was offered, introduced and trained by the partner, the partner helped to find the right organisation to work with, your company's

employees truly understood the meaning of self-direction and teamwork, new approaches to customer service have been developed, your company gone through, a change of attitude and new ways of thinking in the company at managerial or shoofloor level, etc.)?

If product upgrading:

Has / had your company introduced onto the market any new brands, brand extensions, line extensions, other (please specify) during or as a result of your relationship with your partner? If yes, how many?

(*New brand* means the product was introduced under a completely or partly new brand name.

Brand extension means the product was introduced in a category with an existing brand name not previously used in that category.

Line extension is the introduction of a new variety, format size, or package of an existing product or brand name.)

Has / had your company introduced onto the market any (technologically) new or improved products during or as a result of your relationship with your partner? If yes, how many?

(A *new product* refers to a product, which offers something significantly different from existing products.

Would you please define these products? In what sense they are/were new? *Minor new product developments by food-processing firms:*

A new formulation contains added or new ingredients that offer a benefit not previously provided by existing products in its category;

New market is an (original and) special category for new products that do not compete with any existing category of products (e.g. a bread maker starts producing wafers);

Packaging refers to a new product packaged in a way that makes it easier to store, handle, prepare, or dispense than others in its category;

A positioning improvement is a new product presented for new users or uses compared to existing products in its category. (e.g. products for high income earners);

Technology improvement refers to a new product with added consumer benefits resulting from the use of new technology.

Minor new product developments by clothing firms:

New material refers to a product that was produced with a completely new material (e.g. fabric, yarn, fibre, microfibre, etc.);

New design refers to a product that was introduced with a completely or partly new design. (e.g. Design change in a shirt by shirt producer);

New style refers to a product that was introduced with a new garment style;

New market is an original and special category for new products that do not compete with any existing category of products. (e.g. Starting to produce trousers by a shirt producer);

A positioning improvement is a new product presented for new users or uses compared to existing products in its category. (e.g. to a new group of people with high income – luxury products. This is mainly associated with product differentiation);

Technology improvement refers to a new product with added consumer benefits resulting from the use of new technology. (e.g. new stitches used in shirts as a result of special stitch machines)).

Have you made any patent application for any of these new products? (if applicable)

Do you think your company has / had achieved better product quality with this new or improved product? In what sense (use of better quality inputs, use of advanced technologies, etc.)?

What do you think is/was the extent of influence of your partner in the development of this new or improved product?

Do you know whether any other company in your domestic market produces the same / similar product(s)? Are/were they your competitors in the domestic market?

How do you think your company has/had benefited from the development of this new product with regard to the overall strategy of your firm (competence building or competition enhancement)?

Does / did your company improve the quality of your products over the years (as compared to 1989, to 1994 and to 1998)? Is / was there a role of ISO certification in this

improvement? If so, what and how is / was it? To what extent do you think it is/ was related to your partners? Which partners in particular?

If process upgrading:

What kind of advanced process technologies and new machinery has your company introduced into your production system since 1989? To what extent is it related to your partnerships with other organisations? (This question is both to double-check and to complement any lacking information about the technology acquisitions mentioned while responding to the questions about relationships with sources of technology such as technology suppliers, universities, research institutes, etc.)

In which of the following manufacturing processes has your company introduced new advances, technologies and machinery since your company has been privatised or if your company has been established after the transition, then since the start-up? To what extent is it related to your partnerships with other organisations? (*Food-processing firms*: Veterinary, Bacteriology, Cooking/Heating, Freezing, Ingredients, Process chemistry, Mechanical engineering, Automation, Packaging, Other (please specify); *Clothing firms*: changing the lay-out, Fabric preparation, Cutting, Materials handling, Fusing, Sewing, Pressing, Finishing, Garment dyeing, Warehousing, Other (please specify)).

Has your company made any patent application for any of these processes?

Has your company introduced or improved the use of computer systems within the company and for business purposes?

In your opinion, to what extent this improvement in process technologies is /was related to your relationship with this partner?

How do you think your company has/had benefited from this improvement in process technologies with regard to the level of production and utilisation capacity of your company? (increased / decreased / unchanged)

If managerial upgrading:

What kind of novelties has/had your company introduced to your organisational system in production and non-production activities during or as a result of your relationship with your partner? (formal in-house training, involvement of workers- regular participation of workers in production decisions or in problem-solving, quality programmes - application of ISO 9000/14000 (quality assurance standards set by the International Standards Organisation) certificate and Hazard Analysis and Critical Control Point (HACCP) in the food-processing industry, restructuring of your manufacturing activities so as to increase the efficiency in the firm, frequent job rotation of employees, Statistical Process Control (SPC- a techniques for ensuring high quality production in an economical, timely fashion resulting in production free from non-conformance), etc.), co-operation between departmental teams in product/process development (e.g. production, marketing and R&D departments within the firm), use of profit sharing arrangements and forms of incentive-driven pay with workers, joint labour-management committees, self-directed work groups or teams.

What kind of novelties has/had your company introduced to your managerial system during or as a result of your relationship with your partner? (approach to training - use of consultancy, human resource companies, use of college/university programmes for management training, introducing teamwork - self-directed work groups or teams and/or co-operation between departmental teams in product/process development (e.g. production, marketing and R&D departments within the firm), re-organisation of the managerial activities, etc.)

If functional upgrading:

Has/had your company introduced new functions into your company activities during or as a result of your relationship with your partner? (design, if yes, new (innovative) design or translating designs into technical specifications; marketing (for your own products); distribution, human resources; quality control, research and product development, etc.). What do you think the extent of the influence of your partner in introducing this new function in your company?

13. Firm strategies

How do you think your company has/had benefited from this relationship with regard to the overall strategy of your firm (choose one according to the nature of the relationship: to improve your products, processes, managerial practices, quality management or to add new functions to your company) (competence building or competition enhancement)?

What do you think about domestic inputs in your industry (with regard to quality and quantity)? What is the share of international supply markets in your inputs? What is your company's strategy with regard to your supply markets in general (to use foreign suppliers, to train / work with domestic suppliers to increase the quality of their production, etc.)?

What do you think about domestic products market in your industry (with regard to quality, competitiveness, etc.)? Do / did your company export (your own products, OEM products, private-label products, etc.)? To which international markets? If stopped exporting, when and why? If started exporting to new markets, how and through which means (intermediaries, global buyers, FTOs, etc.)? How competitive is/ was your company do you think in those markets? What is your company's strategy with regard to your end product markets in general (focus on expanding your product range – new design skills, on improving reputation through marketing and branding, on improving distribution, etc.)? What does your company do to improve your competitiveness in your market?

What does/did your firm strategically expect or target to gain from this particular relationship? (to develop a specific skill [in what area?], to improve competence of the firm in a specific area [which is what?], have access to new scientific and technological advances [regarding what?], have access to information on products, markets, technologies [how does your company use these information? In which areas of your company? In which markets?], simply to gather knowledge about a specific subject in which the firm is interested in but could not get information in any other way [what is/was it?], to improve its competitiveness in an end product market [which product market? With which product? Is it a new product?], to reduce uncertainty in supplier market [how?], any other reason)

Has/ did this relationship met/meet your expectations? (to double-check if the company is consistent with the answers about what the outcome of the relationship has been so far / was)

How does/did this gain from this particular relationship influence your company strategy with regard to involving in more relationships in order to [whatever is said above]? (to understand if the firm has developed more tendency towards competence-building or competitiveness enhancement after this experience)

14. General opinion about engaging in a relationship

Which of the following factors in your relationship have/had role in impeding your desired level of gains from your partner? (Lack of appropriate finance, Inadequate technical support from/to your partner, Lack of qualified personnel in your partner or your company, Lack of skilled workers in your partner or your company, Organisational rigidities arising from your partner or your company, Technical rigidities arising from your partner or your company, Lack of ability of your partner or your company to improve product quality, Lack of ability of your partner or your company to improve production flexibility, Lack of ability of your partner or your company to meet standards, Other, please specify)

What is/are/ was/were the significant problem(s) you have faced in the relationships you have established so far?

Would you please comment on the main advantages and disadvantages of having relationship with other organisations for your company?

15. Government and the EU

What has/had been the role of local and national governments in promoting the following in favour of the performance of your company and your industry? (Sectoral subsidy, Tax incentives / exemptions, Effective policies to encourage foreign investments, Effective policies to encourage local supplier development, Support for industry-university collaboration, Support for technology transfer, Support for firm-based R&D, Support for training of technical staff, Financial support for start-up firms, Incentives for privatised firms, Market and export services and incentives, Government procurement of goods/services, Setting of technical standards, Other, please specify)

What kind of relations have you had with the EU level organisations?

(Area specific incentives, Industrial promotion, Financial support, Joint projects, Training programmes, Standard specifications, Other please specify)

What kind of benefits has your company received from the above organisations?

(Market information, Information about government programmes, Information about the future directions of the industry, Information about training programmes, Development of new business programmes, Information about competitors, Information about new products/processes in the industry, Other please specify)

Last word

Is there anything in our discussion that you would like to comment on or that you think hasn't been mentioned despite its significance?

Thank you very much for your involvement and support in this research.

APPENDIX E: INTERVIEWS QUESTIONS (WITH OTHER ORGANISATIONS)

About the institution/centre/agency:

- 1) Is your institution a private or a public organisation?
- 2) Is your institution a profit or a non-profit organisation?
- 3) Has your institution affected during the transition in 1990 from the restructuring of institutions? How?
- 4) What is the main objective of your institution/centre/agency?
- 5) What are your activities in the industry? (production and services – what exactly?; projects – with whom?; research – at what level?; support industry – in what ways?)
- 6) Does your institution/centre undertake any projects with foreign and/or domestic companies? What is your institution's position in these projects?
- 7) To what extent do you think the companies are technologically capable to join to the projects?
- 8) With what kind of domestic organisations does your institution cooperate?
- 9) What kind of support does your institution give to the companies that demand either to cooperate with your institution or to help them to find partners for technological development purposes? (Approximately how many firms have applied with these demands in the last two-three years?)
- 10) Does your institution finance projects undertaken by companies, jointly with other organisations, companies or alone?
- 11) How do you select these companies or organisations to award projects?
- 12) Does your institution have cooperation with universities? (about what? – product, process development, knowledge exchange, etc.; for how long?)
- 13) Does your institute initiate cooperation between companies and universities? (example?, rate of success?)
- 14) Are there any training programmes offered by your institution to the companies? (what sort of?, to what kind of groups of people/ who are the targeted people?)
- 15) To what extent do you think these training programmes contribute to the spin-offs of people within the industry and therefore to the technology development and diffusion? (Spin-offs of people: spread/dissemination/diffusion of knowledge through mobility of people)
- 16) Does your institute have strategies for encouraging the spin-offs of people? How? (Do you encourage them to go to industry after educating?)

Thoughts about government activities/policies:

- 17) To what extent do you think there is effective investment of government in the human infrastructure within the industry? (through support to universities' engineering departments)
- 18) What do you think the impacts of these investments are on the technological development of companies?
- 19) Does your institution have a strategy/ policy for technology development and diffusion within the industry?
- 20) Do you think the state has a direct intervention to co-ordinate technological development and diffusion among the organisations and/or companies?
- 21) About which of the following does your institution provide information to the companies in the industry?

Market information

- Information about government programmes
- Information about the future directions of the industry
- Information about training programmes
- Development of new business programmes
- Information about competitors
- Information about new products/processes in the industry
- Other (please specify) _____

- 22) Does your institution receive financial support from the government? How much? Or what percentage of your income?

Situation of Industry:

- 1) How many companies do you have totally in this industry? Would you please categorise them as foreign and domestic, and as large, medium and small enterprises?
- 2) Do you think that the industry has changed compared to the situation in 1990? (enhanced in the domestic market? worsened relative to the world market?)
- 3) What do you think has changed markedly/substantially/remarkably since the transition in terms of technological development within the industry?
- 4) What do you think the level of technology in the industry has upgraded or downgraded since the transition?
- 5) What do you think the kinds of markets the industry is selling have upgraded or downgraded since the transition?
- 6) What were the necessities for modernisation and restructuring of the industry at the time of transition? What sort of investments was needed for this and approximately how much? (to IT, to machinery, to management personnel, to engineers, etc.)
- 7) To what extent these needs are satisfied, both domestically and foreign-based?
- 8) What do you think is the influence (positive or negative) of foreign companies in the industry?
- 9) What do you think are the differences between technological levels of majority of the firms in the industry? (according to firm size and foreign-domestic ownership)
- 10) Do you have any statistics regarding the technological level of the firms in this industry?
- 11) Were there any linkages and networking relationships among companies and between companies and other organisations before transition? Is networking something they were used to? Or was it in a different form? How?
- 12) What has been changed after transition? (in terms of engagement of foreign firms, domestic firms in networks; in terms of firm size – involvement of large firms and small firms)
- 13) Do you think the impact of these networks is positive or negative in the improvement of industry?
- 14) To what extent do you think there is relationship in terms of knowledge transfer between suppliers and customers within the industry? To what directions does this go?
- 15) To which country do you think the level of technology in this industry equivalent?
- 16) Do you think there is any destructive government policy against the industry?

Role of Government / State:

1) In which of the following does the government play an active and effective role in favour of both domestic companies and the industry? (1: no role, 2: slightly helpful, 3: moderately helpful, 4: extremely helpful)

	Domestic firms				Industry			
	1	2	3	4	1	2	3	4
Sectoral subsidy								
Tax incentives / exemptions								
Effective policies to encourage foreign investments								
Effective policies to encourage local supplier development								
Support for industry-university collaboration								
Support for technology transfer								
Support for firm-based research								
Support for training of technical staff								
Financial support for start-up firms								
Incentives for privatised firms								
Market and export services and incentives								
Government procurement of goods/services								
Setting of technical standards								
Other (please specify)								

2) Are there any incentives, e.g. bursaries, scholarships, etc., given by the state to students for education abroad in technology-related subjects?

3) Are there any government policies to communicate with and/or call back the expatriates abroad?

4) What kind of government subsidies is given to the companies for the development of industry after transition? (e.g. tax exemptions, incentives, etc. with the provision of something, e.g. development of local suppliers)

5) Is there an effective investment of government in the human infrastructure within the industry? (through support to universities' engineering departments)

6) Does state have any kind of projects with or without the companies and/or other organisations for the technological development of companies in these industries?

7) Are there any training programmes offered by government units to the companies?

8) Does government have any policies to attract FDI? What are they? (e.g. business environment)

9) What kinds of facilities are provided by the local/national government(s) for companies to improve their infrastructure?

10) Do you think government has effective policies for development of networks between companies and other organisations? (strengthening and supplementing networks)

11) Do you think government has effective policies for local supplier development in this industry?

12) Is there any cluster of firms or the like (science park) in any region of Poland? If yes, is there any supporting networking institution for this cluster nearby?

13) Are there any government policies for network developments? How effective they are? What do you propose to improve them?

Role of EU/Eureka Programmes:

1) Are there any efforts of the EU, in a systematised way, to improve the relationships between West European and Romanian research units or to undertake joint projects? If yes, to what extent does EU finance these relationships?

2) If there is any, what are the major EU policies that Romanian government should comply with for the development of the industry?

3) How do EU policies affect the government policies towards the industry?

4) How do you expect the accession to the EU affect the activities of your institution in the future?

5) Do EU programmes provide support to the domestic and/or foreign companies in the following? Since when?

Area specific incentives

Industrial promotion

Financial support

Joint projects

Training programmes _____
 Standard specifications _____
 Other (please specify) _____

Table E.1 Details of the interviews in public and private organisations

Organisations visited	Interviewees
Technical University of Lodz, Faculty of Textile Engineering and Marketing, Department of Clothing Technology and Textronics	Dr. Marian Rybicki (lecturer and researcher) and Dr. Iwona Frydrych (lecturer and researcher) (group interview)
Warmia-Mazury University, Olsztyn (various departments related to food industry)	Prof. Stefan Ziajka (director of Institute of Dairy Science and Technology Development) and Adam Cybulski (PhD student in the Institute of Dairy Science and Technology Development), assoc. Prof. Lidia Zander (Institute of Process Engineering and Equipment-application of chemical engineering in food industry), Prof. Marek Cierach (Head of Department of Meat Technology and Chemistry, School of Nutrition)
Polish Academy of Sciences (KBN), Warsaw	Dr. Jan Kozłowski (member of KBN)
Central Statistical Office (GUS), Warsaw	Dr. Grazyna Niedbalska (head of production and services statistics division)
Polish Centre for Testing and Certification (PCBC), Warsaw	Dr. Joana Tkaczyk (head of European Relations and European Integration), Dr. Andrzej Rostkowski, Mr. Zbigniew Buchwald, Mrs. Danuta Orleanska (Deputy Director of the Auditor Certification Group of the Training Centre)
Polish Agency for Foreign Investment (PAIZ), Warsaw	Adam Zołnowski (director of research department), Hanna Piotrowska (Project Manager)
Institute for Plant Breeding and Acclimatization, Jadwisin Branch	Dr. Wojciech Nowacki (head of Jadwisin Branch), Dr. Anna Głuska (Deputy head of Potato Agronomy Department) and two researchers
Institute of Natural Fibres, Poznan	Prof. Dr. Ryszard Kozłowski (director), Przemysław Baraniecki (department for hemp breeding, cultivation and seed management and responsible for cooperation with the EU Framework Programmes) and Witold Czeszak (economic advisor), and Małgorzata Muzyczek (head of marketing)
Polish Chamber of Commerce	Katarzyna Grzejszczyk (project manager)
Centre for Social and Economic Research Foundation (CASE), Warsaw	Dr. Piotr Kozarzewski (senior expert), Michał Gorzyski (vice president), Dr. Richard Woodward (economist)

Source: Interviews by the author

APPENDIX F: SUPPLEMENTARY AND DETAILED TABLES TO THE ANALYSES IN CHAPTER 7, 8 AND 9

Table F.1 Cross-tabulation tables and chi-square tests of dependent variables by network type

	All firms								Food-processing firms								Clothing firms							
	Knowledge networks		Production networks		Distribution networks		Arm's length relations		Knowledge networks		Production networks		Distribution networks		Arm's length relations		Knowledge networks		Production networks		Distribution networks		Arm's length relations	
	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%
Total relationships	141	30.2	180	38.5	40	8.6	106	22.7	103	52.8	36	18.5	14	7.2	42	21.5	38	14.0	144	52.9	26	9.6	64	23.5
Learning mechanisms external to the firm																								
Knowledge spillovers	49	34.8	39	21.7	10	2.5	27	25.5	42	40.8	3	8.3	0	0.0	10	23.8	7	18.4	36	25.0	10	38.5	17	26.6
Advances in S&T and education	73	51.8	2	1.1	0	0.0	34	32.1	47	45.6	1	2.8	0	0.0	19	45.2	26	68.4	1	0.7	0	0.0	15	23.4
By interacting	5	3.5	113	62.8	24	60.0	15	14.2	2	1.9	27	75.0	12	85.7	5	11.9	3	7.9	86	59.7	12	46.2	10	15.6
No learning	14	9.9	26	14.4	6	15.0	30	28.2	12	11.7	5	13.9	2	14.3	8	19.0	2	5.3	21	14.6	4	15.4	22	34.4
Types of firm-level upgrading																								
Managerial upgrading	52	36.9	12	6.7	1	2.5	7	6.6	41	39.8	2	5.6	0	0.0	2	4.8	11	28.9	10	6.9	1	3.8	5	7.8
Process upgrading	58	41.1	34	18.9	0	0.0	36	34.0	40	38.8	5	13.9	0	0.0	15	35.7	18	47.4	29	20.1	0	0.0	21	32.8
Product upgrading	13	9.2	36	20.0	1	2.5	12	11.3	8	7.8	2	5.6	1	7.1	5	11.9	5	13.2	34	23.6	0	0.0	7	10.9
Functional upgrading	8	5.7	63	35.0	33	82.5	18	17.0	7	6.8	20	55.6	10	71.4	6	14.3	1	2.6	43	29.9	23	88.5	12	18.8
No upgrading	10	7.1	35	19.4	5	12.5	33	31.1	7	6.8	7	19.4	3	21.4	14	33.3	3	7.9	28	19.4	2	7.7	19	29.7
Pearson Chi-square tests																								
	Chi-square		Degrees of freedom		Asymp.sig.2-sided		Chi-square		Degrees of freedom		Asymp.sig.2-sided		Chi-square		Degrees of freedom		Asymp.sig.2-sided		Chi-square		Degrees of freedom		Asymp.sig.2-sided	
NETYPE v EXTLEARN	221.971		9		0.000		122.878		9		0.000		145.313		9		0.000		145.313		9		0.000	
NETYPE v UPGTYPE	200.159		12		0.000		97.598		12		0.000		94.438		12		0.000		94.438		12		0.000	

Source: Own dataset, SPSS v.17

Table F.2 Cross-tabulation tables and chi-square tests of dependent variable by main independent variable in Upgrading Models (Chapter 8)

	All firms								Food-processing firms								Clothing firms							
	Knowledge spillovers		Advances in S&T		By interacting		No learning		Knowledge spillovers		Advances in S&T		By interacting		No learning		Knowledge spillovers		Advances in S&T		By interacting		No learning	
	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%	count	%
Total relationships	125	26.8	109	23.3	157	33.6	76	16.3	55	28.2	67	34.4	46	23.6	27	13.8	70	25.7	42	15.4	111	40.8	49	18.0
Types of firm-level upgrading																								
Managerial upgrading	27	21.6	21	19.3	6	3.8	18	23.7	24	43.6	12	17.9	0	0.0	9	33.3	3	4.3	9	21.4	6	5.4	9	18.4
Process upgrading	22	17.6	65	59.6	27	17.2	14	18.4	11	20.0	38	53.7	6	13.0	5	18.5	11	15.7	27	64.3	21	18.9	9	18.4
Product upgrading	25	20.0	9	8.3	25	15.9	3	3.9	5	9.1	6	9.0	2	4.3	3	11.1	20	28.6	3	7.1	23	20.7	0	0.0
Functional upgrading	31	24.8	6	5.5	68	43.3	17	22.4	9	16.4	4	6.0	26	56.5	4	14.8	22	31.4	2	4.8	42	37.8	13	26.5
No upgrading	20	16.0	8	7.3	31	19.7	24	31.6	6	10.9	7	10.4	12	26.1	6	22.2	14	20.0	1	2.4	19	17.1	18	36.7
Pearson Chi-square tests																								
	Chi-square		Degrees of freedom		Asymp.sig.2-sided		Chi-square		Degrees of freedom		Asymp.sig.2-sided		Chi-square		Degrees of freedom		Chi-square		Degrees of freedom		Asymp.sig.2-sided		Chi-square	
EXTLEARN v UPGTYPE	138.68		12		0.000		86.542		12		0.000		87.822		12		87.822		12		0.000		87.822	

Source: Own dataset, SPSS v.1

APPENDIX F.1 MULTIPLE CORRESPONDENCE ANALYSIS FOR DATA REDUCTION

Multiple correspondence analysis (MCA) was carried out for the reduction of categories to eliminate zero cell problem in Chapter 7. It is a useful method for analysing cross-tabulations with a large number of rows and columns, as in the case of Tables F.1 and F.2 above, because it is difficult to pick out the important patterns in the data from such tables. It has tools for easier and simple visualisation in two dimensions (Bartholomew *et al.* 2002). It develops the quantifications for the variables by optimal scaling²⁰⁶ whose categorisations locate as separate from each other as possible. While being separate from each other along the x- or y-axis, these categories come closer to other categories of variables, creating homogenous subgroups. This means that these categories frequently co-occur. This is where the term *homogeneity* in ‘homogeneity analysis’ comes from. In cases with a lot of categorical variables, MCA is benefited for data reduction purposes. Some analysts refer to correspondence analysis (CA) as factor analysis of correspondences due to the same mathematical technique used in optimal scaling as in principal component analysis, yet it applies when the relationship between the variables is not linear or when the variables are nominal (de Nooy, 2003: 307-8). In MCA, it is not possible to tell whether there is a causal relationship between these variables or not and also not possible to “say anything about the *magnitude* of their interaction in an absolute sense” (Bartholomew *et al.*, 2002: 92). Hence, it is important to note that the level of (dis)association is in *relative* terms, and not absolute terms. In other words, the categories that are close to each other are more strongly associated than (or compared to) the categories that are far apart from each other.

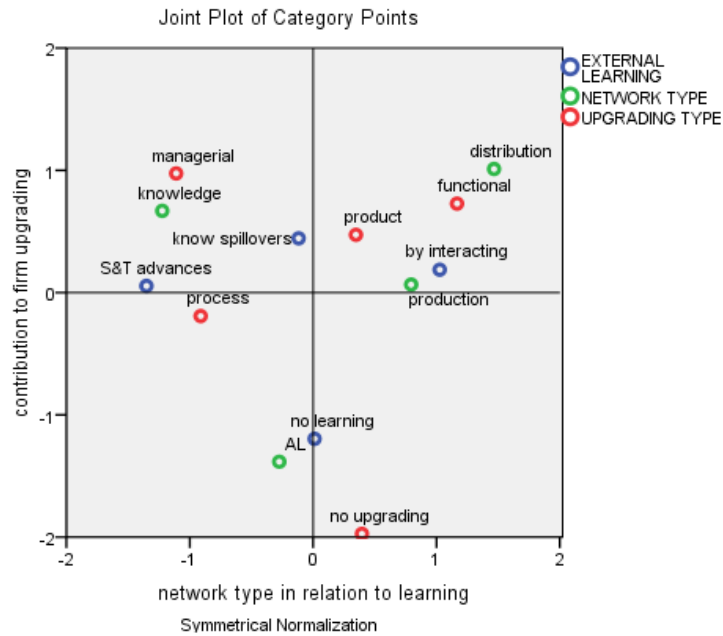
In the dataset, slightly more than all of the variance is accounted for by the MCA solution: 69.1% by the first dimension and 47% by the second dimension. According to the discrimination measures, network types and learning mechanisms external to the firm explain best the first dimension. Types of firm-level upgrading explain both dimensions. They all display large discrimination measures, indicating a high degree of discrimination between the categories of these variables along each dimension (Tables F.3.1 and F.3.2 and Figure F.2 at the end of the text). Therefore, the first dimension distinguishes between knowledge networks and production & distribution networks. It also distinguishes learning mechanisms externally generated by formal search processes such as learning from advances in S&T and education and learning externally generated by consumption through learning by interacting with users and producers. So, the first dimension distinguishes network types in relation to from where the learning emanates. The second dimension can be interpreted as an indicator of the presence of the contribution of networks and learning to any firm-level upgrading type against no upgrading. So, the second dimension simply represents the types of firm-level upgrading. Figure F.1 shows a symmetric biplot for the two-dimensional solution. It is visually apparent that distribution networks and learning from advances in S&T and education are far apart, however, distribution networks are more close to production networks than knowledge networks (Figure F.1)

In general, Figure 7.1 shows three homogenous subgroups. Therefore, MCA have found that the network types, learning mechanisms external to the firm and types of firm-level upgrading are clearly associated, but the questions about the nature and the strength of these relationships is a question for MLR. A detailed analysis of the MCA results is not provided due to space restrictions, but is available upon request. Only the sub-group that is located at the negative end

²⁰⁶ Optimal scaling is an approach of weighing variables to find an optimum way of assigning scores to the variable categories in the analysis of association that would be compatible with regression and correlation (Bartholomew *et al.* 2002: 90).

of dimension 2 is worth mentioning here: Arm's length relations are relatively unlikely to yield learning and to contribute to any of the firm-level upgrading types. This sub-group is a perfect fit for reference categories. As a result, CA guided me to determine the reference categories and to simplify the variable 'network type' used in more sophisticated econometric analysis in the following chapters.

Figure F.1 Symmetric biplot for MCA solution²⁰⁷



Source: Own dataset, SPSS version 17.0

Table F.3.1 Model Summary of MCA results

Model Summary				
Dimension	Cronbach's Alpha	Variance Accounted For		
		Total (Eigenvalue)	Inertia	% of Variance
1	.963	8.989	.691	69.146
2	.906	6.106	.470	46.969
Total		15.095	1.161	
Mean	.940 ^a	7.547	.581	58.058

a. Mean Cronbach's Alpha is based on the mean Eigenvalue.

²⁰⁷There are two types of plots: asymmetric and symmetric. Symmetric plot is considered more generally useful (Bartholomew *et al.*, 2002: 92).

Source: Own dataset, SPSS v.17

Table F.3.2 Discrimination measures and graph from MCA results

Reading the graphs of discrimination measure is as follows: For each variable, a discrimination measure, which can be regarded as a squared component loading, is computed for each dimension. This measure is also the variance of the quantified variable in that dimension. While the variables that are close to the horizontal dimension explain the x-axis better (first dimension), those that are close to the vertical dimension explain the y-axis better (second dimension). Large discrimination measures correspond to a large spread among the categories of the variable and, consequently, indicate a high degree of discrimination between the categories of a variable along that dimension (SPSS).

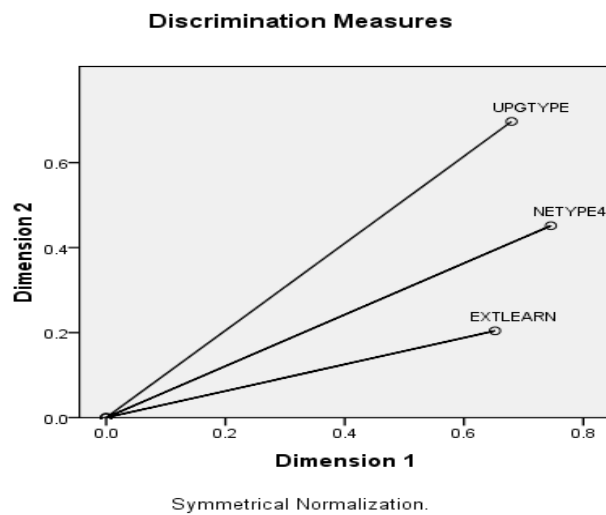
Discrimination Measures

	Variable Weight	Dimension		Mean
		1	2	
NETYPE4	4	.746	.451	.599
EXTLEARN	4	.652	.204	.428
UPGTYPE	5	.680	.697	.688
Active Total ^a		8.989	6.106	7.547
% of Variance		69.146	46.969	58.058

a. Variable weights are incorporated in the Active Total statistics.

Source: Own dataset, SPSS v.17

Figure F.2 Discrimination graph from MCA results



Source: Own dataset, SPSS v.17

Table F.4 The comparison of Learning Models with and without the variable ‘Network Type’

		LM final model							LM without the variable NETYPE								
Logit functions	Variables	B	Std error	Wald	χ² test	Sig.	95% Confidence Interval for Odds Ratio		B	Std error	Wald	χ² test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio		
							Lower	Upper							Lower	Upper	
Learning from knowledge spillovers	Constant	-1.16	.74	2.51		.113			-1.33	.73	3.28		.070				
	food-processing vs clothing industry	.58	.41	2.01		.156	1.78	.80	3.97	.64	.36	3.14		.076	1.90	.93	3.80
	knowledge networks vs arm's length relations	.31	.56	.31		.579	1.36	.46	4.05								
	production and distribution networks vs arm's length relations	.03	.54	.00		.953	1.03	.36	2.99								
	foreign vs domestic partners	1.11	.43	6.82		.009	3.04	1.32	7.02	1.06	.41	6.57		.010	2.88	1.28	6.40
	the firm vs the partner initiates the relationship	-.79	.39	4.06		.044	.45	.21	.98	-.77	.38	4.07		.044	.46	.22	.90
	continuous relations vs one-off	.96	.45	4.67		.031	2.62	1.09	6.26	1.05	.42	6.09		.014	2.85	1.24	6.50
	occasional relations vs one-off	.45	.52	.74		.391	1.56	.56	4.35	.63	.52	1.46		.226	1.87	.68	5.10
	informal vs formal relations	1.50	.46	10.78		.001	4.47	1.83	10.93	1.54	.45	11.60		.001	4.66	1.92	11.20
	uni- vs bi-directional know ledge transfer	-.38	.42	.81		.367	.69	.30	1.56	-.41	.41	.97		.324	.67	.30	1.40
	technology-related vs market-related know ledge	-1.01	.66	2.31		.129	.36	.10	1.34	-.84	.61	1.88		.171	.43	.13	1.40
	production-related vs market-related know ledge	-.15	.64	.05		.817	.86	.25	3.03	.01	.54	.00		.992	1.01	.35	2.90
business and quality management-related vs market-related know ledge	.23	.65	.13		.723	1.26	.35	4.47	.40	.59	.47		.494	1.49	.47	4.70	
there is mobility in the relationship	1.94	.42	21.05		.000	6.98	3.04	16.01	2.06	.40	26.56		.000	7.84	3.58	17.10	
Learning from advances in S&T and education	Constant	-4.12	1.06	15.13		.000			-4.28	1.00	18.48		.000				
	food-processing vs clothing industry	.81	.43	3.57		.059	2.25	.97	5.20	1.57	.38	16.87		.000	4.81	2.27	10.10
	knowledge networks vs arm's length relations	1.53	.54	7.93		.005	4.60	1.59	13.30								
	production and distribution networks vs arm's length relations	-1.99	.88	5.04		.025	.14	.02	.78								
	foreign vs domestic partners	-.07	.49	.02		.887	.93	.35	2.45	.26	.43	.36		.549	1.29	.56	3.00
	the firm vs the partner initiates the relationship	1.19	.53	4.99		.025	3.29	1.16	9.36	1.28	.49	6.82		.009	3.59	1.38	9.30
	continuous relations vs one-off	-1.20	.55	4.69		.030	.30	.10	.89	-1.27	.48	7.20		.007	.28	.11	.70
	occasional relations vs one-off	-.20	.49	.17		.684	.82	.31	2.14	.11	.46	.06		.812	1.12	.45	2.70
	informal vs formal relations	.24	.55	.18		.668	1.27	.43	3.74	.14	.51	.08		.779	1.15	.42	3.10
	uni- vs bi-directional know ledge transfer	1.63	.62	7.04		.008	5.12	1.53	17.11	1.28	.56	5.21		.022	3.59	1.20	10.70
	technology-related vs market-related know ledge	1.63	.76	4.60		.032	5.09	1.15	22.53	1.59	.70	5.21		.022	4.90	1.25	19.10
	production-related vs market-related know ledge	1.11	.80	1.93		.165	3.03	.63	14.51	1.12	.71	2.53		.112	3.08	.77	12.20
business and quality management-related vs market-related know ledge	1.73	.81	4.57		.033	5.66	1.15	27.70	1.86	.75	6.19		.013	6.45	1.49	27.90	
there is mobility in the relationship	.83	.47	3.20		.074	2.30	.92	5.72	1.51	.40	14.00		.000	4.52	2.05	9.90	
Learning by interacting	Constant	-1.76	.78	5.14		.023			-.93	.70	1.74		.187				
	food-processing vs clothing industry	1.00	.41	6.05		.014	2.72	1.23	6.04	.14	.34	.17		.684	1.15	.59	2.20
	knowledge networks vs arm's length relations	-.91	.75	1.50		.221	.40	.09	1.73								
	production and distribution networks vs arm's length relations	2.10	.58	13.07		.000	8.18	2.62	25.55								
	foreign vs domestic partners	1.23	.42	8.59		.003	3.43	1.50	7.80	.81	.38	4.48		.034	2.26	1.06	4.80
	the firm vs the partner initiates the relationship	-.11	.39	.09		.767	.89	.42	1.91	-.48	.35	1.87		.171	.62	.31	1.20
	continuous relations vs one-off	.44	.41	1.12		.291	1.55	.69	3.49	.96	.38	6.49		.011	2.61	1.25	5.40
	occasional relations vs one-off	.00	.56	.00		.998	1.00	.33	3.02	.03	.52	.00		.949	1.03	.38	2.80
	informal vs formal relations	.20	.49	.17		.676	1.22	.47	3.17	.45	.46	.95		.330	1.56	.64	3.80
	uni- vs bi-directional know ledge transfer	.47	.43	1.24		.266	1.61	.70	3.71	.55	.40	1.90		.168	1.74	.79	3.80
	technology-related vs market-related know ledge	-2.31	.74	9.84		.002	.10	.02	.42	-1.41	.62	5.07		.024	.24	.07	.80
	production-related vs market-related know ledge	-.47	.67	.49		.485	.63	.17	2.33	.69	.50	1.87		.172	1.98	.74	5.30
business and quality management-related vs market-related know ledge	-.63	.69	.85		.358	.53	.14	2.04	.24	.56	.18		.668	1.27	.42	3.80	
there is mobility in the relationship	1.26	.46	7.49		.006	3.53	1.43	8.70	.77	.40	3.63		.057	2.15	.98	4.70	
	No of observations					467								467			
	Log Likelihood					-338.936								-375.755			
	LR Chi-Square					459.217								338.422			
	Degrees of Freedom					39								33			
	Prob > Chi-Square					0.000								0.000			
	Pseudo R2 (McFadden)					0.363								0.268			
	Correct classification					66.2%								57.4%			
	Variable Selection Method used:					Stepwise (backward elimination)								Stepwise (backward elimination)			
	Variable removed from the MLR analysis:					PERIOD								PERIOD			
	Reference outcome					No learning during the relationship											
	*** p < 0.01; ** p < 0.05; * p < 0.10; standard errors are in parenthesis.																

Table F.5 Cross-tabulations of dependent variable (EXTLEARN) and independent variables for univariate analysis in Learning Model

Variable	EXTLEARN	learning from knowledge spillovers				learning from advances in S&T				learning by interacting				no learning				Total	
	Variable categories	Count	% within EXTLEARN	% within variable	% of Total	Count	% within EXTLEARN	% within variable	% of Total	Count	% within EXTLEARN	% within variable	% of Total	Count	% within EXTLEARN	% within variable	% of Total	Count	% within EXTLEARN
INDUSTRY	food	55	44.0%	28.2%	11.8%	67	61.5%	34.4%	14.3%	46	29.3%	23.6%	9.9%	27	35.5%	13.8%	5.8%	195	41.8%
	clothing	70	56.0%	25.7%	15.0%	42	38.5%	15.4%	9.0%	111	70.7%	40.8%	23.8%	49	64.5%	18.0%	10.5%	272	58.2%
PERIOD	late90s	66	52.8%	25.2%	14.1%	68	62.4%	26.0%	14.6%	88	56.1%	33.6%	18.8%	40	52.6%	15.3%	8.6%	262	56.1%
	mid90s	41	32.8%	31.1%	8.8%	33	30.3%	25.0%	7.1%	37	23.6%	28.0%	7.9%	21	27.6%	15.9%	4.5%	132	28.3%
	early90s	18	14.4%	24.7%	3.9%	8	7.3%	11.0%	1.7%	32	20.4%	43.8%	6.9%	15	19.7%	20.5%	3.2%	73	15.6%
NETYPE	knowledge	49	39.2%	34.8%	10.5%	73	67.0%	51.8%	15.6%	5	3.2%	3.5%	1.1%	14	18.4%	9.9%	3.0%	141	30.2%
	production & distribution	49	39.2%	22.3%	10.5%	2	1.8%	.9%	.4%	137	87.3%	62.3%	29.3%	32	42.1%	14.5%	6.9%	220	47.1%
	AL	27	21.6%	25.5%	5.8%	34	31.2%	32.1%	7.3%	15	9.6%	14.2%	3.2%	30	39.5%	28.3%	6.4%	106	22.7%
INITIATOR	the firm	66	52.8%	22.6%	14.1%	99	90.8%	33.9%	21.2%	73	46.5%	25.0%	15.6%	54	71.1%	18.5%	11.6%	292	62.5%
	the partner	59	47.2%	33.7%	12.6%	10	9.2%	5.7%	2.1%	84	53.5%	48.0%	18.0%	22	28.9%	12.6%	4.7%	175	37.5%
FORMALITY	informal	57	45.6%	51.8%	12.2%	15	13.8%	13.6%	3.2%	28	17.8%	25.5%	6.0%	10	13.2%	9.1%	2.1%	110	23.6%
	formal	68	54.4%	19.0%	14.6%	94	86.2%	26.3%	20.1%	129	82.2%	36.1%	27.6%	66	86.8%	18.5%	14.1%	357	76.4%
	frequent	77	61.6%	31.4%	16.5%	20	18.3%	8.2%	4.3%	114	72.6%	46.5%	24.4%	34	44.7%	13.9%	7.3%	245	52.5%
FREQUENCY	infrequent	26	20.8%	28.9%	5.6%	38	34.9%	42.2%	8.1%	12	7.6%	13.3%	2.6%	14	18.4%	15.6%	3.0%	90	19.3%
	once	22	17.6%	16.7%	4.7%	51	46.8%	38.6%	10.9%	31	19.7%	23.5%	6.6%	28	36.8%	21.2%	6.0%	132	28.3%
GEORIGIN	foreign	66	52.8%	24.7%	14.1%	64	58.7%	24.0%	13.7%	101	64.3%	37.8%	21.6%	36	47.4%	13.5%	7.7%	267	57.2%
	domestic	59	47.2%	29.5%	12.6%	45	41.3%	22.5%	9.6%	56	35.7%	28.0%	12.0%	40	52.6%	20.0%	8.6%	200	42.8%
DIRECTION	uni-directional	89	71.2%	23.2%	19.1%	103	94.5%	26.9%	22.1%	134	85.4%	35.0%	28.7%	57	75.0%	14.9%	12.2%	383	82.0%
	bi-directional	36	28.8%	42.9%	7.7%	6	5.5%	7.1%	1.3%	23	14.6%	27.4%	4.9%	19	25.0%	22.6%	4.1%	84	18.0%
CONTENT	technology-related	19	15.2%	17.0%	4.1%	64	58.7%	57.1%	13.7%	8	5.1%	7.1%	1.7%	21	27.6%	18.8%	4.5%	112	24.0%
	production-related	52	41.6%	25.9%	11.1%	18	16.5%	9.0%	3.9%	104	66.2%	51.7%	22.3%	27	35.5%	13.4%	5.8%	201	43.0%
	business & quality management-related	37	29.6%	33.9%	7.9%	23	21.1%	21.1%	4.9%	32	20.4%	29.4%	6.9%	17	22.4%	15.6%	3.6%	109	23.3%
	market-related	17	13.6%	37.8%	3.6%	4	3.7%	8.9%	.9%	13	8.3%	28.9%	2.8%	11	14.5%	24.4%	2.4%	45	9.6%
MOBILITY	there is mobility	76	60.8%	41.8%	16.3%	55	50.5%	30.2%	11.8%	38	24.2%	20.9%	8.1%	13	17.1%	7.1%	2.8%	182	39.0%
	there is no mobility	49	39.2%	17.2%	10.5%	54	49.5%	18.9%	11.6%	119	75.8%	41.8%	25.5%	63	82.9%	22.1%	13.5%	285	61.0%
Total		125	100.0%	26.8%	26.8%	109	100.0%	23.3%	23.3%	157	100.0%	33.6%	33.6%	76	100.0%	16.3%	16.3%	467	100.0%

Source: Own dataset, SPSS v. 17

Table F.6 The comparison of Learning Model with and without zero restrictions

Logit functions	Variables	LM with zero restrictions						LM without zero restrictions (full specifications model)					
		B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio	B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio
						Lower	Upper					Lower	Upper
Learning from knowledge spillovers	Constant	-1.16	.74	2.51	.113			-1.42	.83	2.97	.085		
	food-processing vs clothing industry	.58	.41	2.01	.156	1.78	.80	.57	.41	1.92	.166	1.76	.79
	late 1990s vs early 1990s							.15	.47	.10	.756	1.16	.46
	mid-1990s vs early 1990s							.41	.51	.65	.422	1.51	.55
	knowledge networks vs arm's length relations	.31	.56	.31	.579	1.36	.46	.34	.56	.36	.547	1.40	.47
	production and distribution networks vs arm's length relations	.03	.54	.00	.953	1.03	.36	.06	.55	.01	.917	1.06	.36
	foreign vs domestic partners	1.11	.43	6.82	.009	3.04	1.32	1.12	.43	6.89	.009	3.07	1.33
	the firm vs the partner initiates the relationship	-.79	.39	4.06	.044	.45	.21	-.78	.39	3.94	.047	.46	.21
	continuous relations vs one-off	.96	.45	4.67	.031	2.62	1.09	.99	.45	4.88	.027	2.70	1.12
	occasional relations vs one-off	.45	.52	.74	.391	1.56	.56	.43	.52	.68	.410	1.54	.55
	informal vs formal relations	1.50	.46	10.78	.001	4.47	1.83	1.47	.46	10.21	.001	4.34	1.76
	uni- vs bi-directional knowledge transfer	-.38	.42	.81	.367	.69	.30	-.36	.42	.72	.397	.70	.31
	technology-related vs market-related knowledge	-1.01	.66	2.31	.129	.36	.10	-1.03	.67	2.36	.125	.36	.10
	production-related vs market-related knowledge	-.15	.64	.05	.817	.86	.25	-.12	.65	.04	.848	.88	.25
	business and quality management-related vs market-related knowledge	.23	.65	.13	.723	1.26	.35	.24	.65	.13	.718	1.27	.35
	there is mobility in the relationship	1.94	.42	21.05	.000	6.98	3.04	1.95	.43	20.92	.000	7.01	3.04
Learning from advances in S&T and education	Constant	-4.12	1.06	15.13	.000			-4.51	1.14	15.52	.000		
	food-processing vs clothing industry	.81	.43	3.57	.059	2.25	.97	.79	.43	3.34	.068	2.20	.94
	late 1990s vs early 1990s							.56	.57	.94	.333	1.74	.57
	mid-1990s vs early 1990s							.36	.61	.35	.554	1.44	.43
	knowledge networks vs arm's length relations	1.53	.54	7.93	.005	4.60	1.59	1.45	.55	7.02	.008	4.26	1.46
	production and distribution networks vs arm's length relations	-1.99	.88	5.04	.025	.14	.02	-1.99	.89	5.01	.025	.14	.02
	foreign vs domestic partners	-.07	.49	.02	.887	.93	.35	-.06	.50	.01	.904	.94	.36
	the firm vs the partner initiates the relationship	1.19	.53	4.99	.025	3.29	1.16	1.16	.54	4.71	.030	3.20	1.12
	continuous relations vs one-off	-1.20	.55	4.69	.030	.30	.10	-1.17	.56	4.39	.036	.31	.10
	occasional relations vs one-off	-.20	.49	.17	.684	.82	.31	-.14	.50	.08	.775	.87	.33
	informal vs formal relations	.24	.55	.18	.668	1.27	.43	.22	.55	.16	.690	1.25	.42
	uni- vs bi-directional knowledge transfer	1.63	.62	7.04	.008	5.12	1.53	1.64	.62	6.98	.008	5.16	1.53
	technology-related vs market-related knowledge	1.63	.76	4.60	.032	5.09	1.15	1.63	.77	4.53	.033	5.11	1.14
	production-related vs market-related knowledge	1.11	.80	1.93	.165	3.03	.63	1.14	.81	2.01	.157	3.14	.65
	business and quality management-related vs market-related knowledge	1.73	.81	4.57	.033	5.66	1.15	1.70	.82	4.32	.038	5.48	1.10
	there is mobility in the relationship	.83	.47	3.20	.074	2.30	.92	.85	.47	3.28	.070	2.33	.93
Learning by interacting	Constant	-1.76	.78	5.14	.023			-1.94	.84	5.30	.021		
	food-processing vs clothing industry	1.00	.41	6.05	.014	2.72	1.23	.99	.41	5.89	.015	2.69	1.21
	late 1990s vs early 1990s							.17	.44	.16	.691	1.19	.50
	mid-1990s vs early 1990s							.28	.49	.33	.564	1.33	.51
	knowledge networks vs arm's length relations	-.91	.75	1.50	.221	.40	.09	-.90	.75	1.44	.230	.41	.09
	production and distribution networks vs arm's length relations	2.10	.58	13.07	.000	8.18	2.62	2.11	.58	13.13	.000	8.25	2.63
	foreign vs domestic partners	1.23	.42	8.59	.003	3.43	1.50	1.24	.42	8.60	.003	3.44	1.51
	the firm vs the partner initiates the relationship	-.11	.39	.09	.767	.89	.42	-.11	.39	.08	.775	.89	.42
	continuous relations vs one-off	.44	.41	1.12	.291	1.55	.69	.44	.42	1.09	.297	1.55	.68
	occasional relations vs one-off	.00	.56	.00	.998	1.00	.33	-.02	.57	.00	.975	.98	.32
	informal vs formal relations	.20	.49	.17	.676	1.22	.47	.16	.49	.11	.742	1.17	.45
	uni- vs bi-directional knowledge transfer	.47	.43	1.24	.266	1.61	.70	.50	.43	1.33	.248	1.64	.71
	technology-related vs market-related knowledge	-2.31	.74	9.84	.002	.10	.02	-2.33	.74	10.01	.002	.10	.02
	production-related vs market-related knowledge	-.47	.67	.49	.485	.63	.17	-.47	.67	.49	.484	.62	.17
	business and quality management-related vs market-related knowledge	-.63	.69	.85	.358	.53	.14	-.65	.69	.88	.348	.52	.14
	there is mobility in the relationship	1.26	.46	7.49	.006	3.53	1.43	1.27	.46	7.46	.006	3.56	1.43
	No of observations				467						467		
	Log Likelihood				-338.936						-337.863		
	LR Chi-Square				459.217						461.364		
	Degrees of freedom				39						45		
	Prob > Chi-Square				0.000						0.000		
	Pseudo R2 (McFadden)				0.363						0.365		
	Correct classification				66.2%						67.7%		
	Variable Selection Method used:				Stepwise (backward elimination)						Stepwise (backward elimination)		
	Variable removed from the MLR analysis:				PERIOD						PERIOD		
	Reference outcome				No learning during the relationship								

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.

Table F.7 The detailed comparison of baseline and final Learning Models

		LM baseline model							LM final model								
Logit functions	Variables	B	Std error	Wald χ ² test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio		B	Std error	Wald χ ² test	Sig.	Odds Ratio	Confidence Interval for Odds Ratio			
							Lower	Upper						Lower	Upper		
Learning from knowledge spillovers	Constant	-.962	.598	2.588	.108				-1.165	.735	2.508	.113					
	food-processing vs clothing industry	.143	.380	.141	.707	1.153	.548	2.429	.579	.408	2.014	.156	1.785	.802	3.97		
	knowledge networks vs arm's length relations	1.008	.468	4.637	.031	2.739	1.095	6.853	.309	.557	.308	.579	1.362	.457	4.05		
	production and distribution networks vs arm's length relations	-.031	.446	.005	.944	.969	.404	2.323	.032	.542	.004	.953	1.033	.357	2.99		
	foreign vs domestic partners	.688	.358	3.690	.055	1.990	.986	4.015	1.113	.426	6.816	.009	3.045	1.320	7.02		
	the firm vs the partner initiates the relationship	-.729	.372	3.846	.050	.482	.233	1.000	-.789	.392	4.057	.004	.454	.211	.97		
	continuous relations vs one-off	1.054	.415	6.453	.011	2.870	1.272	6.474	.962	.445	4.672	.031	2.617	1.094	6.26		
	occasional relations vs one-off	.621	.489	1.610	.204	1.860	.713	4.853	.448	.521	.737	.391	1.564	.563	4.34		
	informal vs formal relations	2.016	.420	23.025	.000	7.506	3.295	17.099	1.498	.456	10.780	.001	4.471	1.829	10.93		
	uni- vs bi-directional know ledge transfer								-.378	.419	.813	.367	.685	.301	1.55		
	technology-related vs market-related know ledge								-1.008	.664	2.308	.129	.365	.099	1.34		
	production-related vs market-related know ledge								-.148	.641	.053	.817	.862	.245	3.03		
	business and quality management-related vs market-related know ledge								.229	.647	.125	.723	1.258	.354	4.47		
	there is mobility in the relationship								1.943	.424	21.050	.000	6.981	3.044	16.01		
Learning from advances in S&T and education	Constant	-1.832	.725	6.379	.012				-4.116	1.058	15.131	.000					
	food-processing vs clothing industry	.700	.394	3.150	.076	2.014	.930	4.363	.809	.428	3.566	.059	2.246	.970	5.19		
	knowledge networks vs arm's length relations	2.062	.457	20.350	.000	7.861	3.209	19.253	1.526	.542	7.934	.005	4.601	1.591	13.30		
	production and distribution networks vs arm's length relations	-1.855	.820	4.072	.044	.191	.038	.954	-1.986	.885	5.039	.025	.137	.024	.77		
	foreign vs domestic partners	.688	.399	2.977	.084	1.990	.911	4.348	-.070	.494	.020	.887	.932	.354	2.45		
	the firm vs the partner initiates the relationship	1.449	.517	7.844	.005	4.261	1.545	11.748	1.191	.533	4.990	.025	3.291	1.157	9.36		
	continuous relations vs one-off	-1.433	.503	8.124	.004	.239	.089	.639	-1.199	.553	4.695	.030	.302	.102	.89		
	occasional relations vs one-off	-.184	.467	.155	.694	.832	.333	2.079	-.199	.489	.165	.684	.820	.314	2.13		
	informal vs formal relations	.366	.510	.514	.473	1.442	.530	3.920	.237	.553	.184	.668	1.267	.429	3.74		
	uni- vs bi-directional know ledge transfer								1.633	.616	7.036	.008	5.119	1.532	17.10		
	technology-related vs market-related know ledge								1.627	.759	4.599	.032	5.091	1.150	22.52		
	production-related vs market-related know ledge								1.110	.798	1.931	.165	3.033	.634	14.50		
	business and quality management-related vs market-related know ledge								1.733	.811	4.568	.033	5.655	1.155	27.69		
	there is mobility in the relationship								.833	.465	3.201	.074	2.299	.924	5.72		
Learning by interacting	Constant	-1.869	.652	8.232	.004				-1.761	.777	5.138	.023					
	food-processing vs clothing industry	.533	.371	2.061	.151	1.704	.823	3.529	1.001	.407	6.054	.014	2.722	1.226	6.04		
	knowledge networks vs arm's length relations	-.576	.649	.788	.375	.562	.157	2.006	-.914	.747	1.498	.221	.401	.093	1.73		
	production and distribution networks vs arm's length relations	2.052	.459	19.990	.000	7.782	3.166	19.131	2.101	.581	13.067	.000	8.176	2.617	25.54		
	foreign vs domestic partners	1.096	.371	8.746	.003	2.993	1.447	6.190	1.231	.420	8.593	.003	3.426	1.504	7.80		
	the firm vs the partner initiates the relationship	-.121	.374	.104	.747	.886	.426	1.844	-.115	.388	.088	.767	.891	.417	1.90		
	continuous relations vs one-off	.700	.393	3.173	.075	2.013	.932	4.347	.438	.414	1.115	.291	1.549	.688	3.48		
	occasional relations vs one-off	.307	.528	.339	.561	1.360	.483	3.832	-.001	.564	.000	.998	.999	.331	3.01		
	Informal vs formal relations	.675	.440	2.353	.125	1.964	.829	4.652	.203	.485	.175	.676	1.225	.473	3.17		
	uni- vs bi-directional know ledge transfer								.475	.427	1.239	.266	1.608	.697	3.71		
	technology-related vs market-related know ledge								-2.311	.737	9.840	.002	.099	.023	.42		
	production-related vs market-related know ledge								-.469	.672	.489	.485	.625	.168	2.33		
	business and quality management-related vs market-related know ledge								-.631	.686	.846	.358	.532	.139	2.04		
	there is mobility in the relationship								1.260	.460	7.492	.006	3.527	1.430	8.69		
No of observations					467						467						
Log Likelihood					-291.199						-338.936						
LR Chi-Square					381.816						459.217						
Degrees of freedom					24						39						
Prob > Chi-Square					0.000						0.000						
Pseudo R2 (McFadden)					0.302						0.363						
Correct classification					62.1%						66.2%						
Variable Selection Method used:		Stepwise (backward elimination)							Stepwise (backward elimination)								
Variable removed from the MLR analysis:						PERIOD								PERIOD			
Reference outcome		No learning during the relationship															
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in parenthesis.																	

Table F.8 The Likelihood Ratio Test results of baseline and final Learning Models

Likelihood Ratio Tests								
Effect	LM baseline model				LM final model			
	Model Fitting Criteria	Likelihood Ratio Tests			Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	582.398	.000	0	.	677.872	.000	0	.
INDUSTRY	587.444	5.046	3	.168	685.534	7.662	3	.054
PERIOD	582.398	2.583	6	.859	677.872	2.146	6	.906
NETYPE	737.207	154.809	6	.000	798.667	120.795	6	.000
INITIATOR	607.556	25.159	3	.000	696.557	18.685	3	.000
FORMALITY	621.959	39.561	3	.000	697.686	19.813	3	.000
CONTINUITY	616.520	34.122	6	.000	697.650	19.778	6	.003
GEORIGIN	591.851	9.453	3	.024	691.896	14.023	3	.003
DIRECTION					694.038	16.165	3	.001
CONTENT					713.053	35.181	9	.000
MOBILITY					701.636	23.763	3	.000

Table F.9 Likelihood Ratio Test Statistic (G), Degrees of Freedom (df) and *p*-Value for Interactions of Interest Added to the Learning Model

Interaction	G	df	p
<i>INDUSTRY * PERIOD</i>	<i>7.846</i>	<i>6</i>	<i>.250</i>
<i>INDUSTRY * NETYPE</i>	<i>22.649</i>	<i>6</i>	<i>.001</i>
INDUSTRY * INITIATOR	2.322	3	.508
INDUSTRY * FORMALITY	2.779	3	.427
<i>INDUSTRY * CONTINUITY</i>	<i>14.098</i>	<i>6</i>	<i>.029</i>
INDUSTRY * GEORIGIN	1.211	3	.750
INDUSTRY * CONTENT	6.319	9	.708
<i>INDUSTRY * MOBILITY</i>	<i>8.581</i>	<i>3</i>	<i>.035</i>

* The interaction variables that caused unexpected singularities

in the Hessian matrix are not presented in this table.

Table F.10 The detailed comparison of Learning Models with and without the variable ‘Industry Type’ (INDUSTRY) to find out whether INDUSTRY variable is a confounder or not

		LM final model								LM without the variable INDUSTRY type							
Logit functions	Variables	B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio		B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio			
							Lower	Upper						Lower	Upper		
Learning from knowledge spillovers	Constant	-1.16	.74	2.51	.11				-.91	.71	1.64	.200					
	food-processing vs clothing industry	.58	.41	2.01	.16	1.78	.80	3.97	.47	.54	.78	.378	1.61	.56	4.62		
	knowledge networks vs arm's length relations	.31	.56	.31	.58	1.36	.46	4.05	.47	.54	.78	.378	1.61	.56	4.62		
	production and distribution networks vs arm's length relations	.03	.54	.00	.95	1.03	.36	2.99	-.12	.53	.05	.825	.89	.31	2.52		
	foreign vs domestic partners	1.11	.43	6.82	.01	3.04	1.32	7.02	.93	.41	5.24	.022	2.54	1.14	5.66		
	the firm vs the partner initiates the relationship	-.79	.39	4.06	.04	.45	.21	.98	-.82	.39	4.51	.034	.44	.21	.94		
	continuous relations vs one-off	-.96	.45	4.67	.03	2.62	1.09	6.26	1.06	.44	5.81	.016	2.90	1.22	6.88		
	occasional relations vs one-off	.45	.52	.74	.39	1.56	.56	4.35	.49	.52	.89	.345	1.63	.59	4.50		
	informal vs formal relations	1.50	.46	10.78	.00	4.47	1.83	10.93	1.42	.45	9.91	.002	4.13	1.71	9.98		
	uni- vs bi-directional know ledge transfer	-.38	.42	.81	.37	.69	.30	1.56	-.34	.42	.68	.408	.71	.31	1.60		
	technology-related vs market-related know ledge	-1.01	.66	2.31	.13	.36	.10	1.34	-.81	.65	1.55	.213	.45	.12	1.55		
	production-related vs market-related know ledge	-.15	.64	.05	.82	.86	.25	3.03	-.09	.63	.02	.892	.92	.27	3.16		
	business and quality management-related vs market-related know ledge	.23	.65	.13	.72	1.26	.35	4.47	.21	.64	.11	.741	1.24	.35	4.35		
there is mobility in the relationship	1.94	.42	21.05	.00	6.98	3.04	16.01	1.83	.42	19.30	.000	6.24	2.76	14.11			
Learning from advances in S&T and education	Constant	-4.12	1.06	15.13	.00				-3.68	1.02	13.05	.000					
	food-processing vs clothing industry	.81	.43	3.57	.06	2.25	.97	5.20	1.74	.53	10.64	.001	5.72	2.01	16.25		
	knowledge networks vs arm's length relations	1.53	.54	7.93	.00	4.60	1.59	13.30	1.74	.53	10.64	.001	5.72	2.01	16.25		
	production and distribution networks vs arm's length relations	-1.99	.88	5.04	.02	.14	.02	.78	-2.16	.87	6.08	.014	.12	.02	.64		
	foreign vs domestic partners	-.07	.49	.02	.89	.93	.35	2.45	-.27	.48	.31	.576	.76	.30	1.96		
	the firm vs the partner initiates the relationship	1.19	.53	4.99	.03	3.29	1.16	9.36	1.08	.52	4.38	.036	2.96	1.07	8.17		
	continuous relations vs one-off	-1.20	.55	4.69	.03	.30	.10	.89	-1.04	.54	3.70	.055	.35	.12	1.02		
	occasional relations vs one-off	-.20	.49	.17	.68	.82	.31	2.14	-.14	.49	.09	.770	.87	.33	2.26		
	informal vs formal relations	.24	.55	.18	.67	1.27	.43	3.74	.15	.55	.07	.787	1.16	.40	3.40		
	uni- vs bi-directional know ledge transfer	1.63	.62	7.04	.01	5.12	1.53	17.11	1.63	.61	7.02	.008	5.08	1.53	16.85		
	technology-related vs market-related know ledge	1.63	.76	4.60	.03	5.09	1.15	22.53	1.87	.75	6.18	.013	6.50	1.49	28.44		
	production-related vs market-related know ledge	1.11	.80	1.93	.16	3.03	.63	14.51	1.21	.79	2.34	.126	3.37	.71	15.92		
	business and quality management-related vs market-related know ledge	1.73	.81	4.57	.03	5.66	1.15	27.70	1.77	.81	4.76	.029	5.86	1.20	28.65		
there is mobility in the relationship	.83	.47	3.20	.07	2.30	.92	5.72	.67	.46	2.13	.144	1.95	.80	4.77			
Learning by interacting	Constant	-1.76	.78	5.14	.02				-1.28	.74	2.97	.085					
	food-processing vs clothing industry	1.00	.41	6.05	.01	2.72	1.23	6.04	1.00	.40	6.26	.012	2.72	1.24	5.94		
	knowledge networks vs arm's length relations	-.91	.75	1.50	.22	.40	.09	1.73	-.58	.73	.64	.425	.56	.13	2.33		
	production and distribution networks vs arm's length relations	2.10	.58	13.07	.00	8.18	2.62	25.55	1.91	.57	11.32	.001	6.73	2.22	20.43		
	foreign vs domestic partners	1.23	.42	8.59	.00	3.43	1.50	7.80	1.00	.40	6.26	.012	2.72	1.24	5.94		
	the firm vs the partner initiates the relationship	-.11	.39	.09	.77	.89	.42	1.91	-.16	.39	.18	.671	.85	.40	1.81		
	continuous relations vs one-off	.44	.41	1.12	.29	1.55	.69	3.49	.61	.41	2.26	.133	1.85	.83	4.12		
	occasional relations vs one-off	.00	.56	.00	1.00	1.00	.33	3.02	.13	.55	.06	.807	1.14	.39	3.37		
	informal vs formal relations	.20	.49	.17	.68	1.22	.47	3.17	.06	.48	.02	.899	1.06	.42	2.68		
	uni- vs bi-directional know ledge transfer	.47	.43	1.24	.27	1.61	.70	3.71	.51	.42	1.49	.222	1.67	.73	3.81		
	technology-related vs market-related know ledge	-2.31	.74	9.84	.00	.10	.02	.42	-2.02	.70	8.26	.004	.13	.03	.53		
	production-related vs market-related know ledge	-.47	.67	.49	.48	.63	.17	2.33	-.52	.65	.63	.426	.60	.17	2.13		
	business and quality management-related vs market-related know ledge	-.63	.69	.85	.36	.53	.14	2.04	-.73	.67	1.20	.273	.48	.13	1.78		
there is mobility in the relationship	1.26	.46	7.49	.01	3.53	1.43	8.70	1.11	.45	6.09	.014	3.03	1.26	7.33			
	No of observations				467							467					
	Log Likelihood				-338.936							-321.865					
	LR Chi-Square				459.217							451.555					
	Degrees of freedom				39							36					
	Prob > Chi-Square				0.000							0.000					
	Pseudo R2 (McFadden)				0.363							0.357					
	Correct classification				66.2%							66.6%					
	Variable Selection Method used:				Stepwise (backward elimination)							Stepwise (backward elimination)					
	Variable removed from the MLR analysis:				PERIOD							PERIOD					
	Reference outcome																
	*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.																

Table F.11 The detailed comparison of Interaction Model of Learning with Learning Model

Logit functions	Variables	LM final model							Interaction Model of Learning						
		B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence		B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence	
							Lower	Upper						Lower	Upper
Learning from knowledge spillovers	Constant	-1.16	.74	2.51	.113				-1.97	.96	4.19	.04			
	food-processing vs clothing industry	.58	.41	2.01	.156	1.78	.80	3.97	1.98	1.20	2.72	.10	7.26	.69	76.53
	late 1990s (1998-2001) vs early 1990s (1989-1993)								-.20	.59	.11	.74	.82	.26	2.59
	mid-1990s (1994-1997) vs early 1990s (1989-1993)								.77	.69	1.27	.26	2.17	.56	8.34
	knowledge networks vs arm's length relations	.31	.56	.31	.579	1.36	.46	4.05	.69	1.00	.47	.49	1.99	.28	14.14
	production and distribution networks vs arm's length relations	.03	.54	.00	.953	1.03	.36	2.99	.73	.68	1.16	.28	2.08	.55	7.87
	foreign vs domestic partners	1.11	.43	6.82	.009	3.04	1.32	7.02	.99	.45	4.93	.03	2.70	1.12	6.49
	the firm vs the partner initiates the relationship	-.79	.39	4.06	.044	.45	.21	.98	-.67	.40	2.77	.10	.51	.23	1.13
	continuous relations vs one-off	.96	.45	4.67	.031	2.62	1.09	6.26	1.47	.58	6.41	.01	4.35	1.39	13.58
	occasional relations vs one-off	.45	.52	.74	.391	1.56	.56	4.35	1.40	.73	3.63	.06	4.04	.96	17.00
	informal vs formal relations	1.50	.46	10.78	.001	4.47	1.83	10.93	1.42	.57	6.23	.01	4.15	1.36	12.72
	uni- vs bi-directional knowledge transfer	-.38	.42	.81	.367	.69	.30	1.56	-.35	.43	.65	.42	.71	.30	1.64
	technology-related vs market-related knowledge	-1.01	.66	2.31	.129	.36	.10	1.34	-1.08	.71	2.33	.13	.34	.08	1.36
	production-related vs market-related knowledge	-.15	.64	.05	.817	.86	.25	3.03	-.28	.68	.17	.68	.75	.20	2.88
	business and quality management-related vs market-related knowledge	.23	.65	.13	.723	1.26	.35	4.47	.03	.69	.00	.97	1.03	.27	3.96
	there is mobility in the relationship	1.94	.42	21.05	.000	6.98	3.04	16.01	1.80	.59	9.25	.00	6.03	1.89	19.20
	Food-processing vs Late-90s								.92	1.08	.72	.40	2.50	.30	20.75
	Food-processing vs Mid-90s								-.44	1.16	.15	.70	.64	.07	6.27
	Food-processing vs Knowledge networks								-.64	1.25	.27	.61	.53	.05	6.04
	Food-processing vs Production and distribution networks								-2.05	1.14	3.24	.07	.13	.01	1.20
	Food-processing vs Continuous relations								-1.14	.97	1.40	.24	.32	.05	2.12
	Food-processing vs Occasional relations								-2.03	1.15	3.09	.08	.13	.01	1.26
	Food-processing vs Informal relations								.18	1.07	.03	.86	1.20	.15	9.81
	Food-processing vs Mobility of the people in the relation								-.24	.90	.07	.79	.79	.14	4.57
Learning from advances in S&T and education	Constant	-4.12	1.06	15.13	.000				-4.60	1.30	12.49	.00			
	food-processing vs clothing industry	.81	.43	3.57	.059	2.25	.97	5.20	.77	1.30	.35	.55	2.15	.17	27.31
	late 1990s (1998-2001) vs early 1990s (1989-1993)								-.35	.78	.20	.66	.71	.15	3.24
	mid-1990s (1994-1997) vs early 1990s (1989-1993)								.39	.89	.19	.66	1.48	.26	8.47
	knowledge networks vs arm's length relations	1.53	.54	7.93	.005	4.60	1.59	13.30	2.49	1.01	6.10	.01	12.09	1.67	87.29
	production and distribution networks vs arm's length relations	-1.99	.88	5.04	.025	.14	.02	.78	-2.20	1.32	2.77	.10	.11	.01	1.48
	foreign vs domestic partners	-.07	.49	.02	.887	.93	.35	2.45	.09	.54	.03	.87	1.10	.38	3.14
	the firm vs the partner initiates the relationship	1.19	.53	4.99	.025	3.29	1.16	9.36	1.18	.55	4.55	.03	3.25	1.10	9.61
	continuous relations vs one-off	-1.20	.55	4.69	.030	.30	.10	.89	.43	1.01	.18	.67	1.54	.21	11.23
	occasional relations vs one-off	-.20	.49	.17	.684	.82	.31	2.14	-.14	.76	.03	.85	.87	.20	3.84
	informal vs formal relations	.24	.55	.18	.668	1.27	.43	3.74	-1.44	.96	2.27	.13	.24	.04	1.54
	uni- vs bi-directional knowledge transfer	1.63	.62	7.04	.008	5.12	1.53	17.11	1.41	.65	4.72	.03	4.10	1.15	14.63
	technology-related vs market-related knowledge	1.63	.76	4.60	.032	5.09	1.15	22.53	1.70	.82	4.26	.04	5.45	1.09	27.29
	production-related vs market-related knowledge	1.11	.80	1.93	.165	3.03	.63	14.51	.93	.86	1.18	.28	2.54	.47	13.72
	business and quality management-related vs market-related knowledge	1.73	.81	4.57	.033	5.66	1.15	27.70	1.65	.88	3.55	.06	5.20	.94	28.92
	there is mobility in the relationship	.83	.47	3.20	.074	2.30	.92	5.72	1.89	.74	6.50	.01	6.59	1.55	28.07
	Food-processing vs Late-90s								2.06	1.33	2.39	.12	7.82	.58	106.24
	Food-processing vs Mid-90s								.60	1.44	.18	.68	1.82	.11	30.42
	Food-processing vs Knowledge networks								-1.58	1.25	1.60	.21	.20	.02	2.39
	Food-processing vs Production and distribution networks								.19	1.82	.01	.92	1.20	.03	42.68
	Food-processing vs Continuous relations								-1.69	1.27	1.77	.18	.18	.02	2.22
	Food-processing vs Occasional relations								-.18	1.11	.03	.87	.83	.10	7.25
	Food-processing vs Informal relations								2.55	1.32	3.70	.05	12.76	.95	171.01
	Food-processing vs Mobility of the people in the relation								-1.99	1.02	3.77	.05	.14	.02	1.02

Table F.12 Cross-tabulations of dependent variable (UPGTYPE) and independent variables for univariate analysis in Upgrading Models

Variable	UPGTYPE	managerial upgrading				process upgrading				product upgrading				functional upgrading				no upgrading				Total	
	Variable categories	Count	% within UPGTYPE	% within variable	% of Total	Count	% within UPGTYPE	% within variable	% of Total	Count	% within UPGTYPE	% within variable	% of Total	Count	% within UPGTYPE	% within variable	% of Total	Count	% within UPGTYPE	% within variable	% of Total	Count	% within UPGTYPE
INDUSTRY	food	45	62.5%	23.1%	9.6%	60	46.9%	30.8%	12.8%	16	25.8%	8.2%	3.4%	43	35.2%	22.1%	9.2%	31	37.3%	15.9%	6.6%	195	41.8%
	clothing	27	37.5%	9.9%	5.8%	68	53.1%	25.0%	14.6%	46	74.2%	16.9%	9.9%	79	64.8%	29.0%	16.9%	52	62.7%	19.1%	11.1%	272	58.2%
PERIOD	late90s	49	68.1%	18.7%	10.5%	66	51.6%	25.2%	14.1%	31	50.0%	11.8%	6.6%	77	63.1%	29.4%	16.5%	39	47.0%	14.9%	8.4%	262	56.1%
	mid90s	21	29.2%	15.9%	4.5%	33	25.8%	25.0%	7.1%	19	30.6%	14.4%	4.1%	30	24.6%	22.7%	6.4%	29	34.9%	22.0%	6.2%	132	28.3%
	early90s	2	2.8%	2.7%	.4%	29	22.7%	39.7%	6.2%	12	19.4%	16.4%	2.6%	15	12.3%	20.5%	3.2%	15	18.1%	20.5%	3.2%	73	15.6%
EXTLEARN	from knowledge spillovers	27	37.5%	21.6%	5.8%	22	17.2%	17.6%	4.7%	25	40.3%	20.0%	5.4%	31	25.4%	24.8%	6.6%	20	24.1%	16.0%	4.3%	125	26.8%
	from advances in S&T and education	21	29.2%	19.3%	4.5%	65	50.8%	59.6%	13.9%	9	14.5%	8.3%	1.9%	6	4.9%	5.5%	1.3%	8	9.6%	7.3%	1.7%	109	23.3%
	by interacting	6	8.3%	3.8%	1.3%	27	21.1%	17.2%	5.8%	25	40.3%	15.9%	5.4%	68	55.7%	43.3%	14.6%	31	37.3%	19.7%	6.6%	157	33.6%
	no learning	18	25.0%	23.7%	3.9%	14	10.9%	18.4%	3.0%	3	4.8%	3.9%	.6%	17	13.9%	22.4%	3.6%	24	28.9%	31.6%	5.1%	76	16.3%
INTLEARN	by doing + imitating + failing	6	8.3%	5.2%	1.3%	20	15.6%	17.2%	4.3%	31	50.0%	26.7%	6.6%	32	26.2%	27.6%	6.9%	27	32.5%	23.3%	5.8%	116	24.8%
	by using + monitoring	13	18.1%	10.2%	2.8%	56	43.8%	43.8%	12.0%	15	24.2%	11.7%	3.2%	20	16.4%	15.6%	4.3%	24	28.9%	18.8%	5.1%	128	27.4%
	by using internal resources (training + research)	44	61.1%	33.6%	9.4%	24	18.8%	18.3%	5.1%	11	17.7%	8.4%	2.4%	49	40.2%	37.4%	10.5%	3	3.6%	2.3%	.6%	131	28.1%
	no learning	9	12.5%	9.8%	1.9%	28	21.9%	30.4%	6.0%	5	8.1%	5.4%	1.1%	21	17.2%	22.8%	4.5%	29	34.9%	31.5%	6.2%	92	19.7%
KNOWSHARE	within unit	11	15.3%	6.1%	2.4%	88	68.8%	49.2%	18.8%	19	30.6%	10.6%	4.1%	27	22.1%	15.1%	5.8%	34	41.0%	19.0%	7.3%	179	38.3%
	inter-personal / inter-unit	16	22.2%	7.7%	3.4%	35	27.3%	18.4%	7.5%	38	61.3%	18.4%	8.1%	81	66.4%	39.1%	17.3%	37	44.6%	17.9%	7.9%	207	44.3%
	within firm / divisional level	45	62.5%	55.6%	9.6%	5	3.9%	6.2%	1.1%	5	8.1%	6.2%	1.1%	14	11.5%	17.3%	3.0%	12	14.5%	14.8%	2.6%	81	17.3%
STRATEGY	competence-oriented	33	45.8%	17.0%	7.1%	75	58.6%	38.7%	16.1%	36	58.1%	18.6%	7.7%	28	23.0%	14.4%	6.0%	22	26.5%	11.3%	4.7%	194	41.5%
	competition-oriented	39	54.2%	14.3%	8.4%	53	41.4%	19.4%	11.3%	26	41.9%	9.5%	5.6%	94	77.0%	34.4%	20.1%	61	73.5%	22.3%	13.1%	273	58.5%
Total		72	100.0%	15.4%	15.4%	128	100.0%	27.4%	27.4%	62	100.0%	13.3%	13.3%	122	100.0%	26.1%	26.1%	83	100.0%	17.8%	17.8%	467	100.0%

Source: Own dataset, SPSS v. 17

Table F.13 The comparison of Upgrading Models with time PERIOD with two and three cat.

		UM.1						UM.1 with PERIOD (two categories)							
Logit functions	Variables	B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio		B	Std error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio	
							Lower	Upper						Lower	Upper
managerial upgrading vs no upgrading	Constant	-2.086	.801	6.779	.009				-1.047	.399	6.882	.009			
	food-processing vs clothing industry	.727	.351	4.287	.038	2.069	1.040	4.120	.785	.349	4.800	.028	2.148	1.084	4.258
	late 1990s (1998-2001) vs early 1990s (1989-1993)	1.950	.794	6.024	.014	7.028	1.481	33.345							
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	1.269	.819	2.399	.121	3.558	.714	17.727							
	late 1990s (1998-2001) vs early and mid-1990s (1989-1993)								.839	.347	5.852	.016	2.314	1.173	4.568
	learning from knowledge spillovers vs no learning	.440	.442	.992	.319	1.553	.653	3.695	.484	.439	1.215	.270	1.622	.686	3.833
	learning from advances in S&T and education vs no learning	.865	.539	2.577	.108	2.375	.826	6.829	.910	.537	2.875	.090	2.485	.868	7.116
	learning by interacting vs no learning	-1.405	.554	6.439	.011	.245	.083	.726	-1.406	.551	6.505	.011	.245	.083	.722
process upgrading vs no upgrading	Constant	.061	.441	.019	.890				-.514	.376	1.863	.172			
	food-processing vs clothing industry	-.001	.319	.000	.998	.999	.535	1.867	-.057	.316	.032	.858	.945	.508	1.757
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.708	.407	3.023	.082	.493	.222	1.094							
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-1.117	.445	6.312	.012	.327	.137	.782							
	late 1990s (1998-2001) vs early and mid-1990s (1989-1993)								-.014	.303	.002	.962	.986	.544	1.787
	learning from knowledge spillovers vs no learning	.731	.465	2.468	.116	2.078	.834	5.174	.639	.458	1.952	.162	1.895	.773	4.648
	learning from advances in S&T and education vs no learning	2.835	.524	29.261	.000	17.036	6.098	47.593	2.651	.512	26.802	.000	14.165	5.193	38.643
	learning by interacting vs no learning	.403	.433	.866	.352	1.496	.640	3.498	.399	.427	.873	.350	1.491	.645	3.445
product upgrading vs no upgrading	Constant	-1.773	.705	6.316	.012				-1.963	.642	9.353	.002			
	food-processing vs clothing industry	-.682	.384	3.152	.076	.506	.238	1.073	-.692	.383	3.265	.071	.500	.236	1.060
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.068	.475	.020	.887	.935	.369	2.370							
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-.323	.508	.404	.525	.724	.268	1.959							
	late 1990s (1998-2001) vs early and mid-1990s (1989-1993)								.141	.346	.167	.683	1.152	.585	2.267
	learning from knowledge spillovers vs no learning	2.390	.686	12.126	.000	10.912	2.843	41.885	2.367	.685	11.949	.001	10.669	2.787	40.836
	learning from advances in S&T and education vs no learning	2.408	.794	9.185	.002	11.109	2.341	52.712	2.358	.791	8.890	.003	10.568	2.243	49.787
	learning by interacting vs no learning	1.845	.670	7.571	.006	6.326	1.700	23.541	1.844	.670	7.575	.006	6.325	1.701	23.523
functional upgrading vs no upgrading	Constant	-.727	.469	2.405	.121				-.679	.368	3.404	.065			
	food-processing vs clothing industry	-.051	.308	.027	.869	.950	.520	1.738	-.058	.307	.036	.850	.943	.516	1.724
	late 1990s (1998-2001) vs early 1990s (1989-1993)	.707	.423	2.791	.095	2.028	.885	4.647							
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	.084	.459	.034	.854	1.088	.443	2.673							
	late 1990s (1998-2001) vs early and mid-1990s (1989-1993)								.664	.294	5.101	.024	1.943	1.092	3.458
	learning from knowledge spillovers vs no learning	.792	.433	3.351	.067	2.209	.946	5.159	.797	.432	3.409	.065	2.220	.952	5.176
	learning from advances in S&T and education vs no learning	.002	.637	.000	.997	1.002	.288	3.492	-.010	.635	.000	.988	.990	.285	3.438
	learning by interacting vs no learning	1.104	.387	8.137	.004	3.016	1.413	6.441	1.109	.387	8.206	.004	3.031	1.419	6.471
No of observations					467						467				
Log Likelihood					-148.542						-123.785				
LR Chi-Square					187.441						171.081				
Degrees of freedom					24						20				
Prob > Chi-Square					0.000						0.000				
Pseudo R2 (McFadden)					0.128						0.117				
Correct classification					43.9%						44.5%				
Variable Selection Method used:					Stepwise (backward elimination)						Stepwise (backward elimination)				
Variable removed from the MLR analysis:					None						None				
Reference outcome					No upgrading						No upgrading				
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in parenthesis.															

Table F.14 The Likelihood Ratio Test results of Upgrading Model 1

Likelihood Ratio Tests				
Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	297.085	.000	0	.
EXTLEARN	438.609	141.525	12	.000
INDUSTRY	310.632	13.547	4	.009
PERIOD	326.569	29.484	8	.000

Table F.15 Cross-tabulation between learning mechanisms external and internal to the firm, and the Chi-Square Test results

			INTLEARN				SHARING			Total
			doing+imitating+ failing	using+ monitoring	internal resources	none	within unit	inter- unit/inter- personal	divisional/ within firm	
EXTLEARN	know spillovers	Count	20	34	52	19	40	49	36	125
		% within EXTLEARN	16.0%	27.2%	41.6%	15.2%	32.0%	39.2%	28.8%	100.0%
		% within INTLEARN	17.2%	26.6%	39.7%	20.7%	22.3%	23.7%	44.4%	26.8%
		% of Total	4.3%	7.3%	11.1%	4.1%	8.6%	10.5%	7.7%	26.8%
	S&T advances	Count	2	59	29	19	63	28	18	109
		% within EXTLEARN	1.8%	54.1%	26.6%	17.4%	57.8%	25.7%	16.5%	100.0%
		% within INTLEARN	1.7%	46.1%	22.1%	20.7%	35.2%	13.5%	22.2%	23.3%
		% of Total	.4%	12.6%	6.2%	4.1%	13.5%	6.0%	3.9%	23.3%
	by interacting	Count	77	21	44	15	41	107	9	157
		% within EXTLEARN	49.0%	13.4%	28.0%	9.6%	26.1%	68.2%	5.7%	100.0%
		% within INTLEARN	66.4%	16.4%	33.6%	16.3%	22.9%	51.7%	11.1%	33.6%
		% of Total	16.5%	4.5%	9.4%	3.2%	8.8%	22.9%	1.9%	33.6%
	no learning	Count	17	14	6	39	35	23	18	76
		% within EXTLEARN	22.4%	18.4%	7.9%	51.3%	46.1%	30.3%	23.7%	100.0%
		% within INTLEARN	14.7%	10.9%	4.6%	42.4%	19.6%	11.1%	22.2%	16.3%
		% of Total	3.6%	3.0%	1.3%	8.4%	7.5%	4.9%	3.9%	16.3%
Total		Count	116	128	131	92	179	207	81	467
		% within EXTLEARN	24.8%	27.4%	28.1%	19.7%	38.3%	44.3%	17.3%	100.0%
		% within INTLEARN	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
		% of Total	24.8%	27.4%	28.1%	19.7%	38.3%	44.3%	17.3%	100.0%
	Pearson Chi-Square Tests									
		Value	173.890 ^a				75.629 ^a			
		df	9				6			
		Asymp. Sig. (2-sided)	.000				.000			

Table F.16.1 The first step of testing mediation between learning mechanisms external to the firm and its complementary internal factors (learning mechanisms internal to the firm)

		Mediation Test -Step 1: Regressing mechanisms internal to the firm on learning mechanisms external to the firm						
							95% Confidence Interval for Odds Ratio	
Logit functions	Variables	B	Std. Error	Wald χ ² test	Sig.	Odds Ratio	Lower	Upper
learning by doing +imitating+ailing vs no learning	Constant	-.57	.43	1.72	.190			
	food-processing vs clothing industry	-.80	.33	5.82	0.016**	.45	.23	.86
	late 1990s (1998-2001) vs early 1990s (1989-1993)	.03	.41	.01	.934	1.03	.46	2.33
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-.15	.47	.10	.752	.86	.34	2.18
	learning from knowledge spillovers vs no learning	.95	.44	4.70	0.030**	2.59	1.10	6.11
	learning from advances in S&T vs no learning	-1.24	.81	2.39	.122	.29	.06	1.40
	learning by interacting vs no learning	2.45	.41	36.05	0.000***	11.64	5.23	25.95
	learning by using + monitoring vs no learning	Constant	-1.56	.50	9.52	0.002***		
food-processing vs clothing industry		-.14	.30	.21	.646	.87	.48	1.57
late 1990s (1998-2001) vs early 1990s (1989-1993)		.50	.47	1.12	.290	1.65	.65	4.14
mid-1990s (1994-1997) vs early 1990s (1989-1993)		1.01	.50	4.04	0.045**	2.73	1.03	7.29
learning from knowledge spillovers vs no learning		1.56	.43	13.42	0.000***	4.78	2.07	11.03
learning from advances in S&T vs no learning		2.16	.42	26.50	0.000***	8.64	3.80	19.63
learning by interacting vs no learning		1.37	.46	8.77	0.003***	3.94	1.59	9.78
learning by training + research vs no learning		Constant	-1.78	.54	10.85	0.001***		
	food-processing vs clothing industry	.01	.30	.00	.976	1.01	.56	1.82
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.03	.41	.01	.942	.97	.43	2.18
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-.31	.47	.46	.500	.73	.29	1.82
	learning from knowledge spillovers vs no learning	2.89	.52	31.48	0.000***	18.06	6.57	49.63
	learning from advances in S&T vs no learning	2.29	.54	18.30	0.000***	9.89	3.46	28.27
	learning by interacting vs no learning	2.94	.53	30.61	0.000***	18.89	6.67	53.50
	No of observations				467			
	Log Likelihood				-121.407			
	LR Chi-Square				194.551			
	Degrees of freedom				18			
	Prob > Chi-Square				0.000			
	Pseudo R2 (McFadden)				0.151			
	Correct classification				49.9%			
	Variable Selection Method used: variable removed from the MLR analysis:				Main effects			
					NONE			
	Reference outcome				no learning during the relationship			
*** <i>p</i> < 0.01; ** <i>p</i> < 0.05; * <i>p</i> < 0.10; standard errors are in paranthesis.								

Table F.16.2 The first step of testing mediation between learning mechanisms external to the firm and its complementary internal factors (levels of knowledge sharing within the firm)

		Mediation Test -Step 1: Regressing levels of knowledge sharing within the firm on learning mechanisms external to the firm						
Logit functions		B	Std. Error	Wald χ^2 test	Sig.	Odds Ratio	Interval for Odds	
	Variables						Low er	Upper
within unit	Constant	.90	.44	4.22	.040			
	food-processing vs clothing industry	-.64	.29	4.82	.028	.53	.30	.93
	late 1990s (1998-2001) vs early 1990s (1989-1993)	.25	.41	.38	.539	1.29	.57	2.90
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-.18	.44	.16	.687	.84	.35	1.98
	learning from knowledge spillovers vs no learning	-.49	.38	1.72	.190	.61	.29	1.28
	learning from advances in S&T vs no learning	.73	.41	3.16	.075	2.07	.93	4.62
	learning by interacting vs no learning	.86	.47	3.26	.071	2.35	.93	5.96
	inter-personal / inter-unit	Constant	.57	.47	1.47	.225		
	food-processing vs clothing industry	-1.84	.31	35.39	.000	.16	.09	.29
	late 1990s (1998-2001) vs early 1990s (1989-1993)	.54	.43	1.61	.204	1.72	.75	3.96
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	.06	.46	.02	.902	1.06	.43	2.58
	learning from knowledge spillovers vs no learning	.24	.41	.36	.551	1.28	.57	2.84
	learning from advances in S&T vs no learning	.63	.47	1.81	.178	1.88	.75	4.69
	learning by interacting vs no learning	2.32	.49	22.39	.000	10.13	3.88	26.43
	No of observations				467			
	Log Likelihood				-86.182			
	LR Chi-Square				125.44			
	Degrees of freedom				12			
	Prob > Chi-Square				0.000			
	Pseudo R2 (McFadden)				0.13			
	Correct classification				57.0%			
	Variable Selection Method used:				Main effects			
	Variable removed from the MLR analysis:				NONE			
	Reference outcome				no learning during the relationship			
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.								

Table F.16.3 The third step of testing mediation between learning mechanisms external to the firm and its complementary internal factors

Logit functions	Variables	Mediation Test - Step 3.1: Regressing levels of knowledge sharing within the firm and learning mechanisms external to the firm on types of firm-level upgrading						Mediation Test - Step 3.2: Regressing learning mechanisms internal to the firm and learning mechanisms external to the firm on types of firm-level upgrading					
		B	Std. Error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio	B	Std. Error	Wald χ^2 test	Sig.	Odds Ratio	95% Confidence Interval for Odds Ratio
							Lower Upper						Lower Upper
managerial upgrading vs no upgrading	Constant	-1.14	.88	1.67	.196			-3.08	.90	11.79	0.001***		
	food-processing vs clothing industry	.40	.40	.98	.321	1.49	.68 3.30	.57	.39	2.13	.145	1.76	.82 3.76
	late 1990s (1998-2001) vs early 1990s (1989-1993)	3.00	.86	12.19	0.000***	20.17	3.74 108.91	2.47	.85	8.52	0.004***	11.83	2.25 62.12
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	1.99	.87	5.25	0.022**	7.30	1.33 40.06	1.87	.88	4.50	0.034***	6.51	1.15 36.78
	learning from knowledge spillovers vs no learning	.06	.50	.02	.897	1.07	.40 2.83	-.97	.55	3.14	0.076*	.38	.13 1.11
	learning from advances in S&T vs no learning	.94	.59	2.57	.109	2.55	.81 8.04	-.12	.63	.04	.845	.88	.26 3.02
	learning by interacting vs no learning	-1.27	.59	4.54	0.033**	.28	.09 .90	-2.52	.64	15.42	0.000***	.08	.02 .28
	learning by doing -imitating-failing vs no learning							.51	.64	.64	.424	1.67	.48 5.84
	learning by using + monitoring vs no learning							.68	.57	1.42	.234	1.97	.65 5.99
	learning by using internal resources (training + research) vs no learning							4.59	.78	34.54	0.000***	98.84	21.36 457.29
	within unit vs within firm / divisional level	-2.82	.53	28.34	0.000***	.06	.02 .17						
	inter-personal / inter-unit vs within firm / divisional level	-2.10	.52	16.41	0.000***	.12	.04 .34						
process upgrading vs no upgrading	Constant	-1.33	.70	3.68	0.055**			-.14	.47	.09	.760		
	food-processing vs clothing industry	-.16	.34	.22	.640	.85	.43 1.67	-.09	.33	.07	.791	.92	.48 1.74
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.88	.42	4.40	0.036**	.41	.18 .94	-.61	.42	2.12	.146	.54	.24 1.24
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-1.21	.46	6.95	0.008***	.30	.12 .73	-1.03	.46	4.96	0.026**	.36	.14 .88
	learning from knowledge spillovers vs no learning	.95	.48	3.84	0.050**	2.58	1.00 6.68	.41	.49	.70	.404	1.51	.58 3.94
	learning from advances in S&T vs no learning	2.93	.54	29.51	0.000***	18.81	6.52 54.22	2.57	.55	21.50	0.000***	13.08	4.41 38.79
	learning by interacting vs no learning	.59	.46	1.63	.202	1.81	.73 4.47	.19	.48	.16	.689	1.21	.47 3.10
	learning by doing -imitating-failing vs no learning							.14	.47	.09	.758	1.16	.46 2.89
	learning by using + monitoring vs no learning							.44	.42	1.12	.290	1.56	.69 3.54
	learning by using internal resources (training + research) vs no learning							1.91	.71	7.32	0.007***	6.78	1.69 27.11
	within unit vs within firm / divisional level	1.93	.62	9.63	0.002***	6.91	2.04 23.44						
	inter-personal / inter-unit vs within firm / divisional level	1.01	.65	2.41	.120	2.75	.77 9.83						
product upgrading vs no upgrading	Constant	-2.24	.87	6.63	0.010***			-2.81	.83	11.54	0.001***		
	food-processing vs clothing industry	-.54	.40	1.81	.179	.58	.26 1.28	-.57	.40	2.08	.149	.56	.26 1.23
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.10	.48	.05	.830	.90	.35 2.31	.03	.49	.00	.954	1.03	.39 2.71
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-.35	.51	.47	.492	.70	.26 1.91	-.14	.54	.07	.789	.87	.30 2.49
	learning from knowledge spillovers vs no learning	2.35	.69	11.58	0.001***	10.50	2.71 40.67	2.06	.72	8.27	0.004***	7.85	1.93 31.95
	learning from advances in S&T vs no learning	2.37	.80	8.82	0.003***	10.67	2.24 50.84	2.44	.84	8.44	0.004***	11.53	2.21 60.00
	learning by interacting vs no learning	1.70	.68	6.22	0.013**	5.49	1.44 20.94	1.11	.70	2.50	.114	3.04	.77 12.05
	learning by doing -imitating-failing vs no learning							1.89	.61	9.63	0.002***	6.60	2.00 21.76
	learning by using + monitoring vs no learning							.82	.62	1.76	.184	2.27	.68 7.59
	learning by using internal resources (training + research) vs no learning							2.60	.84	9.65	0.002***	13.42	2.61 69.06
	within unit vs within firm / divisional level	.38	.63	.37	.544	1.47	.43 5.05						
	inter-personal / inter-unit vs within firm / divisional level	.73	.63	1.38	.240	2.08	.61 7.09						
functional upgrading vs no upgrading	Constant	-.69	.59	1.35	.246			-1.13	.52	4.73	0.030**		
	food-processing vs clothing industry	.16	.33	.24	.625	1.17	.62 2.23	-.09	.33	.07	.786	.92	.48 1.73
	late 1990s (1998-2001) vs early 1990s (1989-1993)	.70	.43	2.67	.103	2.02	.87 4.71	1.00	.46	4.78	0.029**	2.72	1.11 6.66
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	.07	.46	.02	.880	1.07	.43 2.65	.50	.50	1.00	.317	1.65	.62 4.40
	learning from knowledge spillovers vs no learning	.70	.44	2.56	.109	2.02	.85 4.79	.14	.47	.09	.761	1.15	.46 2.91
	learning from advances in S&T vs no learning	-.02	.64	.00	.974	.98	.28 3.45	-.42	.67	.39	.530	.66	.18 2.45
	learning by interacting vs no learning	.90	.40	4.97	0.026**	2.46	1.11 5.43	.59	.43	1.86	.172	1.81	.77 4.23
	learning by doing -imitating-failing vs no learning							.17	.43	.16	.693	1.19	.51 2.78
	learning by using + monitoring vs no learning							.10	.45	.05	.832	1.10	.46 2.65
	learning by using internal resources (training + research) vs no learning							2.97	.69	18.55	0.000***	19.54	5.05 75.57
	within unit vs within firm / divisional level	-.55	.49	1.23	.267	.58	.22 1.52						
	inter-personal / inter-unit vs within firm / divisional level	.32	.49	.44	.508	1.38	.53 3.57						
	No of observations				467							467	
	Log Likelihood				-243.982							-275.656	
	LR Chi-Square				310.660							296.959	
	Degrees of freedom				32							36	
	Prob > Chi-Square				.000							.000	
	Pseudo R2 (McFadden)				.212							.203	
	Correct classification				51.4%							50.3%	
	Variable Selection Method used:				Main effects							Main effects	
	Variable removed from the MLR analysis:				NONE							NONE	
	Reference outcome				no upgrading								

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in parenthesis.

Table F.17 The comparison of the results of UM.2 with and without zero restrictions

		UM.2 with zero restrictions							UM.2 without zero restrictions						
Logit functions	Variables						Confidence							Interval for Odds	
		B	Std. Error	Wald χ^2 test	Sig.	Odds Ratio	Lower	Upper	B	Std. Error	Wald χ^2 test	Sig.	Odds Ratio	Lower	Upper
managerial upgrading vs no upgrading	Constant	-1.73	.96	3.25	0.071*				-1.92	1.00	3.68	.055			
	food-processing vs clothing industry														
	late 1990s (1998-2001) vs early 1990s (1989-1993)	3.28	.93	12.43	0.000***	26.45	4.28	163.42	3.31	.94	12.37	.000	27.39	4.33	173.22
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	2.45	.95	6.62	0.010***	11.64	1.79	75.49	2.49	.96	6.66	.010	12.06	1.82	79.87
	learning from knowledge spillovers vs no learning	-1.17	.61	3.71	0.054*	.31	.10	1.02	-1.21	.61	3.91	.048	.30	.09	.99
	learning from advances in S&T vs no learning	.01	.66	.00	.990	1.01	.28	3.69	-.06	.67	.01	.931	.94	.25	3.50
	learning by interacting vs no learning	-2.28	.68	11.20	0.001***	.10	.03	.39	-2.29	.68	11.29	.001	.10	.03	.39
	learning by doing +imitating+ailing vs no learning	-.20	.69	.08	.775	.82	.21	3.18	-.18	.69	.06	.801	.84	.22	3.26
	learning by using + monitoring vs no learning	.49	.61	.64	.423	1.63	.49	5.44	.51	.61	.71	.401	1.67	.50	5.54
	learning by training + research vs no learning	4.08	.81	25.38	0.000***	59.42	12.13	291.18	4.09	.81	25.41	.000	59.79	12.19	293.35
within unit vs within firm / divisional level	-2.59	.58	20.06	0.000***	.08	.02	.23	-2.59	.58	19.95	.000	.07	.02	.23	
inter-personal / inter-unit vs within firm / divisional level	-1.78	.55	10.67	0.001***	.17	.06	.49	-1.69	.56	9.06	.003	.18	.06	.55	
process upgrading vs no upgrading	Constant	-1.68	.71	5.70	0.017**				-1.63	.72	5.12	.024			
	food-processing vs clothing industry														
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.86	.43	3.94	0.047**	.42	.18	.99	-.84	.44	3.70	.055	.43	.18	1.02
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-1.16	.48	5.91	0.015**	.31	.12	.80	-1.14	.48	5.68	.017	.32	.13	.82
	learning from knowledge spillovers vs no learning	.60	.51	1.40	.237	1.83	.67	4.97	.64	.51	1.56	.212	1.90	.69	5.22
	learning from advances in S&T vs no learning	2.61	.56	21.99	0.000***	13.65	4.58	40.72	2.69	.57	22.00	.000	14.66	4.77	45.04
	learning by interacting vs no learning	.29	.51	.33	.564	1.34	.50	3.62	.33	.51	.42	.514	1.40	.51	3.82
	learning by doing +imitating+ailing vs no learning	.33	.49	.46	.500	1.39	.54	3.60	.30	.49	.38	.540	1.35	.52	3.52
	learning by using + monitoring vs no learning	.47	.43	1.21	.271	1.60	.69	3.73	.48	.43	1.24	.266	1.62	.69	3.76
	learning by training + research vs no learning	1.81	.72	6.28	.012	6.09	1.48	24.99	1.78	.72	6.09	.014	5.94	1.44	24.47
within unit vs within firm / divisional level	2.01	.63	10.20	0.001***	7.48	2.18	25.74	2.01	.63	10.09	.001	7.44	2.16	25.65	
inter-personal / inter-unit vs within firm / divisional level	1.16	.65	3.21	0.073*	3.19	.90	11.30	1.11	.65	2.87	.090	3.02	.84	10.87	
product upgrading vs no upgrading	Constant	-3.49	.96	13.18	0.000***				-3.31	.98	11.56	.001			
	food-processing vs clothing industry														
	late 1990s (1998-2001) vs early 1990s (1989-1993)	-.05	.50	.01	.920	.95	.36	2.52	-.01	.50	.00	.992	.99	.37	2.65
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	-.17	.54	.10	.758	.85	.29	2.44	-.15	.54	.08	.784	.86	.30	2.49
	learning from knowledge spillovers vs no learning	1.96	.72	7.42	0.006***	7.07	1.73	28.86	2.00	.72	7.70	.006	7.37	1.80	30.25
	learning from advances in S&T vs no learning	2.20	.83	6.99	0.008***	9.02	1.77	46.02	2.32	.84	7.57	.006	10.14	1.95	52.83
	learning by interacting vs no learning	.88	.71	1.53	.216	2.42	.60	9.81	.93	.72	1.69	.194	2.54	.62	10.33
	learning by doing +imitating+ailing vs no learning	1.92	.61	9.93	0.002***	6.83	2.07	22.58	1.87	.61	9.26	.002	6.47	1.94	21.51
	learning by using + monitoring vs no learning	.84	.62	1.87	.172	2.32	.69	7.74	.84	.62	1.84	.175	2.31	.69	7.76
	learning by training + research vs no learning	2.70	.84	10.44	0.001***	14.95	2.90	77.10	2.66	.84	10.05	.002	14.30	2.76	74.07
within unit vs within firm / divisional level	.49	.65	.56	.452	1.63	.46	5.81	.46	.65	.50	.478	1.58	.45	5.64	
inter-personal / inter-unit vs within firm / divisional level	.92	.63	2.12	.145	2.51	.73	8.70	.78	.64	1.50	.221	2.19	.62	7.67	
functional upgrading vs no upgrading	Constant	-1.08	.64	2.87	0.090*				-1.17	.66	3.21	.073			
	food-processing vs clothing industry														
	late 1990s (1998-2001) vs early 1990s (1989-1993)	.95	.47	4.11	0.043**	2.59	1.03	6.50	.95	.47	4.06	.044	2.58	1.03	6.49
	mid-1990s (1994-1997) vs early 1990s (1989-1993)	.48	.51	.88	.349	1.61	.59	4.35	.49	.51	.92	.338	1.63	.60	4.41
	learning from knowledge spillovers vs no learning	.03	.48	.00	.957	1.03	.40	2.63	.01	.48	.00	.989	1.01	.39	2.59
	learning from advances in S&T vs no learning	-.54	.67	.64	.423	.58	.16	2.18	-.60	.68	.78	.377	.55	.14	2.08
	learning by interacting vs no learning	.33	.45	.54	.463	1.39	.58	3.36	.30	.45	.43	.514	1.34	.55	3.27
	learning by doing +imitating+ailing vs no learning	-.03	.44	.00	.947	.97	.41	2.32	.00	.45	.00	.998	1.00	.42	2.39
	learning by using + monitoring vs no learning	.04	.45	.01	.935	1.04	.43	2.52	.03	.45	.00	.948	1.03	.42	2.51
	learning by training + research vs no learning	3.00	.70	18.63	0.000***	20.17	5.15	78.91	3.02	.70	18.79	.000	20.45	5.23	80.04
within unit vs within firm / divisional level	-.48	.53	.85	.357	.62	.22	1.73	-.48	.53	.81	.367	.62	.22	1.75	
inter-personal / inter-unit vs within firm / divisional level	.59	.50	1.36	.243	1.80	.67	4.80	.65	.51	1.58	.209	1.91	.70	5.22	
	No of observations				467						467				
	Log Likelihood				-354.774						-352.890				
	LR Chi-Square				395.685						399.454				
	Degrees of freedom				40						44				
	Prob > Chi-Square				0.000						0.000				
	Pseudo R2 (McFadden)				.270						.275				
	Correct classification				52.9%						52.9%				
	Variable Selection Method used:				Stepwise (backward elimination)						forced entry				
	Variable removed from the MLR analysis:				INDUSTRY						NONE				
	Reference outcome				no upgrading										
*** p < 0.01; ** p < 0.05; * p < 0.10; standard errors are in paranthesis.															

Table F.18 The Upgrading Model 3 with additional STRATEGY variable (detailed version)

Upgrading Model 3																	
Logit functions	Variables	B	Std error	Wald χ^2 test	Sig.	Odds Ratio	Confidence Lower	Upper	Logit functions	Variables	B	Std error	Wald χ^2 test	Sig.	Odds Ratio	Confidence Lower	Upper
managerial upgrading vs no upgrading	Constant	-1.915	.978	3.832	.050				product upgrading vs no upgrading	Constant	-3.818	.999	14.602	.000			
	late 1990s (1998-2001)	3.406	.942	13.082	.000	30.133	4.759	190.774		late 1990s (1998-2001)	.110	.514	.046	.831	1.116	.407	3.058
	vs early 1990s (1989-1993)									vs early 1990s (1989-1993)							
	mid-1990s (1994-1997)	2.547	.962	7.008	.008	12.763	1.937	84.097		mid-1990s (1994-1997)	-.049	.557	.008	.930	.952	.320	2.839
	vs early 1990s (1989-1993)									vs early 1990s (1989-1993)							
	learning from knowledge spillovers	-1.490	.634	5.519	.019	.225	.065	.781		learning from knowledge spillovers	1.431	.743	3.708	.054	4.184	.975	17.954
	vs no learning									vs no learning							
	learning from advances in S&T and education	-.245	.686	.128	.721	.783	.204	3.003		learning from advances in S&T and education	1.799	.849	4.488	.034	6.042	1.144	31.907
	vs no learning									vs no learning							
	learning by interacting	-2.438	.697	12.241	.000	.087	.022	.342		learning by interacting	.770	.719	1.146	.284	2.160	.527	8.848
	vs no learning									vs no learning							
	learning by doing +imitating+falling	-.168	.701	.058	.810	.845	.214	3.336		learning by doing +imitating+falling	1.990	.618	10.380	.001	7.316	2.180	24.548
	vs no learning									vs no learning							
	learning by using + monitoring	.390	.622	.393	.531	1.477	.436	5.002		learning by using + monitoring	.734	.622	1.393	.238	2.084	.616	7.052
	vs no learning									vs no learning							
learning by training + research	4.003	.816	24.039	.000	54.740	11.051	271.139	learning by training + research	2.574	.845	9.278	.002	13.114	2.503	68.701		
vs no learning								vs no learning									
within unit	-2.775	.601	21.343	.000	.062	.019	.202	within unit	.406	.662	.376	.540	1.501	.410	5.496		
vs within firm / divisional level								vs within firm / divisional level									
inter-personal / inter-unit	-1.859	.554	11.257	.001	.156	.053	.462	inter-personal / inter-unit	.935	.646	2.098	.148	2.547	.719	9.029		
vs within firm / divisional level								vs within firm / divisional level									
competence-oriented								competence-oriented									
vs competition-oriented firm upgrading strategy	.917	.469	3.820	.051	2.502	.997	6.274	vs competition-oriented firm upgrading strategy	1.220	.417	8.546	.003	3.388	1.495	7.679		
process upgrading vs no upgrading	Constant	-1.811	.718	6.372	.012				functional upgrading vs no upgrading	Constant	-1.054	.635	2.756	.097			
	late 1990s (1998-2001)	-.831	.440	3.572	.059	.435	.184	1.031		late 1990s (1998-2001)	.907	.476	3.640	.056	2.478	.975	6.293
	vs early 1990s (1989-1993)									vs early 1990s (1989-1993)	.454	.512	.788	.375	1.575	.578	4.297
	mid-1990s (1994-1997)	-1.125	.482	5.453	.020	.325	.126	.835		mid-1990s (1994-1997)							
	vs early 1990s (1989-1993)									vs early 1990s (1989-1993)							
	learning from knowledge spillovers	.226	.535	.178	.673	1.253	.439	3.575		learning from knowledge spillovers	.055	.497	.012	.912	1.057	.399	2.801
	vs no learning									vs no learning							
	learning from advances in S&T and education	2.375	.564	17.733	.000	10.755	3.560	32.490		learning from advances in S&T and education	-.331	.676	.240	.624	.718	.191	2.704
	vs no learning									vs no learning							
	learning by interacting	.222	.510	.190	.663	1.249	.459	3.396		learning by interacting	.369	.450	.672	.412	1.446	.599	3.492
	vs no learning									vs no learning							
	learning by doing +imitating+falling	.378	.490	.595	.441	1.459	.558	3.815		learning by doing +imitating+falling	-.051	.444	.013	.908	.950	.398	2.270
	vs no learning									vs no learning							
	learning by using + monitoring	.391	.433	.814	.367	1.478	.633	3.451		learning by using + monitoring	.035	.454	.006	.938	1.036	.426	2.521
	vs no learning									vs no learning							
learning by training + research	1.638	.732	5.007	.025	5.143	1.225	21.587	learning by training + research	2.991	.697	18.434	.000	19.897	5.080	77.927		
vs no learning								vs no learning									
within unit	1.946	.636	9.358	.002	6.997	2.012	24.337	within unit	-.357	.532	.449	.503	.700	.247	1.986		
vs within firm / divisional level								vs within firm / divisional level									
inter-personal / inter-unit	1.131	.653	2.994	.084	3.097	.861	11.147	inter-personal / inter-unit	.597	.510	1.370	.242	1.817	.669	4.938		
vs within firm / divisional level								vs within firm / divisional level									
competence-oriented								competence-oriented									
vs competition-oriented firm upgrading strategy	.881	.367	5.767	.016	2.413	1.176	4.950	vs competition-oriented firm upgrading strategy	-.270	.384	.495	.482	.763	.359	1.621		
No of observations					467												
Log Likelihood					-.394.102												
LR Chi-Square					419.178												
Degrees of freedom					44												
Prob > Chi-Square					0.000												
Pseudo R2 (McFadden)					0.286												
Correct classification					53.3%												
Variable Selection Method used:					Stepwise (backward elimination)												
Variable removed from the MLR analysis:					INDUSTRY												
Reference outcome					No upgrading												
*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$; standard errors are in paranthesis.																	

Table F.19 Likelihood Ratio Test Statistic (G), Degrees of Freedom (df) and p-Value for Interactions of Interest Added to the Upgrading Model 3 (UM.3)

Interaction	G	df	p
INDUSTRY * PERIOD	8.183	8	.416
INDUSTRY * INTLEARN	11.785	12	.463
INDUSTRY * SHARING	35.743	8	.000
INDUSTRY * STRATEGY	6.363	4	.174

* The interaction variables that caused unexpected singularities

in the Hessian matrix are not presented in this table.